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BULLETIN 271 JANUARY, 1926

Connecticut Agricultural Experiment Station

New Haven, Connecticut

Spray Bulletin

BY

W. E. BRITTON, *Entomologist.*

AND

G. P. CLINTON, *Botanist.*

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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NEW HAVEN, CONNECTICUT

WILLIAM L. SLATE, JR., *Director*

SPRAY BULLETIN

W. E. BRITTON
Entomologist

G. P. CLINTON
Botanist

DIRECTIONS FOR PREPARING INSECTICIDES AND FUNGICIDES.

FORMULAS FOR INSECTICIDES.

LEAD ARSENATE.

3 lbs. (Paste) or 1½ lbs. (Dry) Lead Arsenate and 50 gals. Water.

Spray upon foliage to kill all chewing insects. May be used with Bordeaux or with lime-sulphur mixture.

PARIS GREEN.

1 lb. Paris Green. 3 lbs. Lime. 100 gals. Water.

Spray upon foliage to kill chewing insects. Commonly used with Bordeaux mixture on potatoes, largely superseded by lead arsenate.

CALCIUM ARSENATE.

1½ lbs. Dry Calcium Arsenate. 1½ lbs. Dry Air-Slaked Lime.
50 gals. Water.

Applied as dust or spray on potatoes. May be used in Bordeaux mixture. Not safe on fruit trees.

POISONED BRAN MASH.

5 lbs. Wheat Bran. 4 ozs. White Arsenic or Paris Green.
1 pint Cheap Molasses. 1 Lemon. 7 pints Water.

Mix to form a dry mash and scatter around field to kill cut-worms, army worms and grasshoppers.

FRESH HELLEBORE.

Dust on the plants, or mix with water, 1 oz. in 2 gals. and spray. For currant-worm and other sawfly larvae.

DRY LIME-SULPHUR.

Winter Spray.

12 lbs. dry Lime-Sulphur. 50 gals. Water.

Summer Spray.

3 lbs. Lime-Sulphur. 50 gals. Water.

LIQUID LIME-SULPHUR.

Winter Spray.

1 part Lime-Sulphur. 9 parts Water.

Summer Spray.

1¼ to 1½ parts Lime-Sulphur. 50 parts Water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

CORROSIVE SUBLIMATE.

1 ounce in 10 gals. water, poured around cabbage plants to prevent injury from cabbage root maggot.

DUST MIXTURES.

Sulphur 85%, lead arsenate 15% (or sulphur 90%, lead arsenate 10%), is used to dust apple orchards for fungous diseases and chewing insects. To kill sucking insects add 2% of nicotine. Copper sulphate 15% to 25%, hydrated lime 80%, and calcium arsenate 5% to 25%, is used successfully in some localities on vegetables but is likely to russet apples. Plain sulphur is used in peach orchards. These dusts can be purchased, mixed ready for use.

LINSEED OIL EMULSION.

1 gal. raw Linseed Oil. 1½ lbs. Soap Flakes. 1 gal. Water.

Dissolve flakes in water; stir in linseed oil and dilute to 100 gals.

NICOTINE SOLUTION.

½ pint of a 40% nicotine sulphate solution in 50 gals. water. Dissolve and add 2 lbs. Laundry Soap or 1 lb. Calcium Caseinate for a spreader.

Excellent for killing aphids and other sucking insects.

KEROSENE EMULSION.

2 gals. Kerosene. 1 lb. Common Soap. 1 gal. Water.

Dissolve the soap in hot water, add the kerosene, and churn together with pump until a white creamy mass is formed, which thickens on cooling. Dilute *nine* times before using for most aphids, but may be used stronger or weaker.

MISCIBLE OILS.

Mix 1 part of "Scalecide," "Jarvis Compound," "Target Scale Destroyer" or other miscible oils with 15 parts of water, to kill San José scale, especially on old apple trees.

COMMON LAUNDRY SOAP.

Spray 1 lb. dissolved in 8 gals. water upon foliage to kill red spider, aphids, and other sucking insects. Soap flakes may be used in half this quantity.

CARBON DISULPHIDE.

To kill insects infesting stored grain, in tight bins, use 1 lb. for about 100 cubic feet of space. Expose for about 36 hours at 60° F. or higher.

CARBON DISULPHIDE EMULSION.

10 parts (volume) Carbon disulphide. 1 part (volume) Cold water soluble rosin fish oil soap. 3 parts (volume) Water.

Churn the soap and water to obtain an even mixture. Then add carbon disulphide and churn about two minutes until the mixture emulsifies as indicated by change in color and a creamy liquid is formed. Dilute 200 times when using and apply one quart per square foot. To kill insects in soil without injuring vegetation.

PARADICHLOROBENZENE.

A granular solid chemical which gives off fumes fatal to insect life. Has recently been used successfully to control the peach borer. Also called "Krystal gas," "Paradichloride," "P. C. Benzene," etc.

NAPHTHALENE.

Used in the form of moth balls and "flakes" to keep clothes moths out of clothing. "Flakes" scattered around the borders of floors and shelves will drive away ants.

CALCIUM CASEINATE SPREADERS.

1-2 lbs. in 100 gals. acts as a spreader and prevents chemical reactions, where different materials are mixed together.

FORMALIN FLY POISON.

1 tablespoonful Commercial Formalin. ½ cup Sweet Milk.
½ cup Water.

Mix and expose in a shallow plate with a slice of bread in it. Flies will drink the liquid, especially if no other moisture is accessible, and be killed.

ANT POISON.

Arsenate Soda 125 grains. Sugar 1 pound. Honey 1 tablespoonful.
Water 1 quart.

Add arsenate soda and sugar to water. Boil until both are dissolved, then add honey. When cool, place in shallow dishes with a crust of bread or bits of sponge.

HYDROCYANIC ACID GAS.

1 oz. Sodium Cyanide. 2 ozs. Sulphuric Acid. 4 ozs. Water.
For each 100 cu. ft. space.

For fumigating dormant nursery stock or buildings, place the acid and water in an earthen jar in the house, drop in the cyanide and close the house at once for half an hour. Ventilate for ten minutes before entering. In greenhouse use 1 oz. of cyanide for each 1000 cu. ft. of space; avoid sunlight; excessive moisture; driving winds. Fumigate, between 52° and 70° F. Calcium Cyanide in granular form may now be obtained for killing grubs, wireworms and ants in soil; and in form of dust for killing aphids and other sucking insects. Caution! Breathing the fumes will cause death.

FORMULAS FOR COMMON FUNGICIDES.

LIQUID LIME-SULPHUR.

Winter Spray.

1 part Lime-Sulphur. 9 parts Water.

Summer Spray.

1¼ to 1½ parts Lime-Sulphur. 50 parts Water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

DRY LIME-SULPHUR.

There are now on the market several forms of dry lime-sulphur or similar fungicides, that because of convenience in shipping and handling are replacing somewhat the more bulky liquid fungicides. Where experience has shown that spray injury does not result from their use, they may be substituted for the latter. Use according to directions given by the manufacturers.

SELF-BOILED LIME-SULPHUR.

8 lbs. Fresh Whitewash Lime. 8 lbs. Fine Sulphur. 50 gals. Water.

Start the lime slaking, sift and thoroughly stir in the sulphur, using just enough water to prevent burning and allow to boil from heat of lime for fifteen minutes. Then dilute and apply.

A very excellent substitute for this fungicide on peaches is the commercial article called "Atomic Sulphur," without lead arsenate, used at the rate of 5 lbs. to 50 gallons water.

DRY MIX.

8 lbs. Sulphur. 4 lbs. Hydrated Lime. 1 lb. Casein Spreader. 50 gals. Water.

Mix thoroughly together the first three ingredients and add to the water when needed. This fungicide is being used more and more in this state as a peach spray.

SULPHUR DUST.

Dusting with special grades of very fine sulphur, about 90 parts thoroughly mixed with 10 parts lead arsenate for apples and 80 parts sulphur and 20 parts air-slaked lime for peaches, or with special material prepared by manufacturers, has attained some prominence as a combined fungicidal and insecticidal treatment for fruit trees. Experience so far in this state seems to show that such treatment is much more effective in controlling insects than fungous troubles of the apple. Good results in controlling peach scab and fair results for brown rot have been obtained. Dusting is much quicker and so cheaper as regards labor, but the cost of the material used is considerably greater.

COPPER DUSTS.

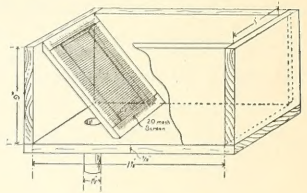
There are now on the market certain commercial dusts containing lime and copper sulphate that combine to form a Bordeaux mixture when in contact with moisture on the leaves. These are coming somewhat into use for certain diseases where dusts can be used to better advantage, so far as mechanical application is concerned, than can Bordeaux mixture. They have been used in this state with more or less success on apples, potatoes and especially on celery. On apples russeting, as with Bordeaux mixture, is likely to result.

BORDEAUX MIXTURE.

4-5 lbs. Copper Sulphate (Blue Vitriol). 5-6 lbs. Fresh Lime. 50 gals. Water.

For small acreage. Dissolve the copper sulphate in hot water. Slake the lime and strain through coarse cheese-cloth. Dilute each separately to 25 gallons. Pour together slowly through a strainer into the spray barrel.

For large acreage. Make stock solutions of copper sulphate and lime as follows: Dissolve 40-50 pounds of copper sulphate in 50 gallons of water, by suspending in a bran sack. One gallon of stock solution thus contains about one pound of copper sulphate. Slake 50-60 pounds of lime, strain into a barrel and make up to 50 gallons. A gallon of this solution contains at least one pound of lime. The excess takes care of waste in slaking. Put two 50-gallon dilution barrels on a platform so that the sprayer can be backed under them. For a 100-gallon sprayer put 10 gallons of stock lime mixture into the lime barrel and 10 gallons of stock copper sulphate solution into the copper sulphate barrel. Dilute each to 50 gallons. By using a molasses spigot for each barrel, the two streams may be run together through a trough into the sprayer. A large, fine wire strainer should be set in the sprayer opening. Lead arsenate, Paris green, or nicotine solution may be added if needed. Hydrated lime is handy to use, but Bordeaux made with it is said by some not to adhere so well and to be more likely to injure apple foliage.



TYPE OF STRAINER RECOMMENDED FOR SPRAY MATERIALS

Some growers get good results with the following method: Start filling the sprayer with water, washing in at same time 10 gallons of the stock lime mixture through the strainer. When half full, add the 10 gallons of stock copper sulphate solution with the remaining water, stirring meanwhile. When short handed, this method saves time. Half these amounts are used for a 50-gallon sprayer.

FORMALIN.

A. 1 pt. (1 lb.) formalin in 50 gals. water, for sprinkling grain to kill smut. See Smut under Oats. Wet sprinkle. Or better:

B. 1 pt. undiluted formalin is *sprayed* directly on 50 bushels of grain as it is shoveled over and then heaped in a pile and covered for four hours. Dry sprinkle.

C. 1 pt. formalin in 30 gals. water; soak uncut tubers 1 hour to prevent potato scab.

D. 1 pt. formalin in 12½ gals. water, for soil treatment. Use one-half to 1 gal. for each square foot of surface treated; cover for 24 hours after treatment; air afterwards and stir soil; allow 7-10 days before seeding and 10-14 days before transplanting in this soil.

CORROSIVE SUBLIMATE.

4 ozs. Corrosive Sublimate. 30 gallons Water.

Dissolve the corrosive sublimate in a small amount of *hot* water and then dilute. Soak uncut seed potatoes in this for ½ to 1 hour. After each treatment renew strength by adding 1 oz. of corrosive sublimate and water as needed to retain the 30 gallons. Use in wooden containers and mark *Poison.* Good for both scab and black scurf.

FORMULAS FOR LESS-USED FUNGICIDES.

OTHER BORDEAUX MIXTURES.

Dilute Bordeaux Mixture. Use 1 lb. copper sulphate, 4 of lime, and make as above directed. For second and third sprayings of apples to lessen russeting of the fruit.

Resin Bordeaux Mixture. Melt 5 lbs. resin with 1 pt. fish oil, cool slightly, add 1 lb. soda lye, stirring. Add 5 gals. water and boil till the mixture will dissolve in cold water. Mix 2 gals. with 48 of Bordeaux mixture. Used sometimes on such glaucous plants as asparagus, cabbage, onions, etc., to make a more adhesive spray.

SPREADERS.

Certain commercial forms of casein are now on the market and can be used in Bordeaux mixture as a spreader instead of the preceding.

COPPER SULPHATE.

2 to 3 lbs. Copper Sulphate. 45-50 gals. Water.

Used chiefly as a winter spray. 1 lb. to 250 gals. water is sometimes though rarely used on foliage.

POTASSIUM SULPHIDE.

3 ozs. Potassium Sulphide. 10 gals. Water.

Used chiefly in greenhouses, or for powdery mildews.

FORMALIN FUMES.

3 pts. Formalin. 23 ozs. Potassium Permanganate.
For each 1000 cu. ft. Space.

Place bulbs or tubers in 6 to 12 in. crates so fumes can get at them. To prevent injury to potatoes, fill space at rate of 167 bu. Place formalin in large pail in cleared central space and drop in the crystals of potassium permanganate. Close room air-tight for 24 to 48 hours.

INSECTS AND THEIR INJURIES TO PLANTS.

Insects are small animals belonging to the class Hexapoda (six-legged) and most of them have six legs in some stage of their existence. Spiders, mites, sow bugs, centipedes and millipedes are animals but not insects and all but certain mites have more than six legs. Insects may be divided roughly into two groups: (1) chewing or biting insects, and (2) sucking insects. The chewing insects (except termites or white ants, and grasshoppers and crickets) have four distinct stages in their life cycles, as follows: (1) egg, (2) caterpillar, grub or larva, (3) pupa, (4) adult insect. Such insects are said to have complete transformations. The exceptions noted above and the sucking insects do not pass through these four well-marked stages. There is usually, though not always, an egg stage, and an adult stage, but there is no pupa (except in case of the males in certain species of scale insects and white flies) and the larvae are called nymphs after hatching from the eggs, and undergo a gradual development, molting several times with only slight changes until the adult stage is reached.

Chewing or biting insects have strong jaws or mandibles with which they bite or tear off bits of food like the higher animals. Such insects swallow their food and here is where an arsenical poison can be employed with success. This class includes all caterpillars, beetles, sawflies, grasshoppers and crickets.

Sucking insects puncture the tissues with their beaks or probosces and suck out the sap for food. Such insects cannot be killed by applying arsenical poisons to plants but must be treated with dusts or contact sprays which will suffocate them and corrode their tissues. Aphids, scale insects, leafhoppers and all plant bugs belong to this class.

Never Spray Fruit Trees When in Bloom. The application of lead arsenate or other arsenical poisons to trees in blossom may do much harm (1) by injuring the essential organs of the flowers, so that fruit will not set, and (2) by killing many of the bees which carry pollen from one tree to another. If all honey bees and native wild bees were killed, there would be little or no set of fruit.

Spraying Versus Dusting. Six years' experiments in Connecticut show that in apple orchards, spraying gives a larger percentage of good fruit than dusting and is less expensive. Dusting gives fairly good control of insect pests but does not hold fungous diseases in check like spraying. Dusting has given as good results as spraying in controlling scab and brown rot on peaches. It is probable that dusts can be used to advantage on low growing vegetable crops, where spraying is impracticable.

Safe Combinations of Sprays. It is safe to mix lead arsenate with lime-sulphur, Bordeaux and nicotine, but none of these should be combined with miscible or other oils. It is also unsafe to use soap with lead arsenate.

FUNGI AND THEIR DISEASES OF PLANTS.

Nature. Fungi are the lowest forms of plant life. They differ from all other plants in lacking the green coloring matter, characteristic of leaves, known as chlorophyll. Lacking this they cannot manufacture from water, gases and the chemical constituents of the soil, their food. This they must obtain in an organized form from products of living or dead plants or animals. If from the living, they produce disease as a result and are called parasites; if from the dead, they merely produce decay and are called saprophytes.

Stages. Fungi consist of two stages: a **mycelium** or vegetative stage that has to do with gathering their food, and spores that perpetuate their existence the same as the seeds do the flowering plants. The vegetative stage is usually inconspicuous and often not visible to the naked eye, as it consists of microscopic branched threads that ramify through the substratum or host, on which it occurs, in search for food. There is comparatively little difference in the appearance of the mycelia of different fungi, hence the necessity of seeing the spores for identification.

The **spores** are formed on or near the surface of the host and are much more conspicuous and differentiated especially as seen under the compound microscope. Mushrooms and shelf fungi are the largest fruiting forms. Smuts and rusts form dusty or granular outbreaks; mildews produce a powdery or downy growth on the infected surfaces; other fungi may have more or less inconspicuous spore stages on the conspicuously injured tissues that show as spots, cankers, etc. Each fungus may have more than one kind of spores, but only one corresponds directly to the seed of the flowering plant in that it is the result of fertilization of the sexual elements, the other kinds being of an asexual nature such as buds, tubers, runners, etc., in plants. Some spores are temporary and are merely useful in quickly spreading the fungus over the host or to new ones. Other spores are more hardy and serve to carry the fungus over unfavorable periods, such as winter. With the rusts, not infrequently, certain spore stages occur as parasites on one host and others on an entirely different host species, thus greatly complicating the life history of the fungus.

Infection. In any case the spores give rise to new individuals by germinating into threads that by later growth form the mycelium. With parasitic forms this germ tube or thread must penetrate in some manner into the living tissues of its host in order to gain the food necessary for its growth. All preventive treatments of fungous diseases by spraying are based on killing the spores that are carried to the susceptible parts of the plants before they can gain entrance by their germ tubes into the tissues. Once inside, the mycelium is no more injured by the spray than the plant tissues on which it is placed. This makes it necessary to protect the tissues by repeated and thorough spraying as long as there is danger of the fungus gaining entrance. It also means that the fungicide must be able to kill the spores or their germ tubes but cause no injury to the plant tissues.

INSECT AND FUNGOUS PESTS OF CULTIVATED PLANTS.

Insects, etc.

ALFALFA.

Aphids—Green and pink aphids suck sap from leaves and stems occasionally ruining crop. Prompt cutting is one method of killing them.

Fungi.

Downy Mildew—Forms a grayish growth on the young shoots and the under sides of the leaves, causing the tissues to turn brown or purplish and finally die. Develops in wet seasons where the plants make a rank growth. As yet rare in this state and so not serious.

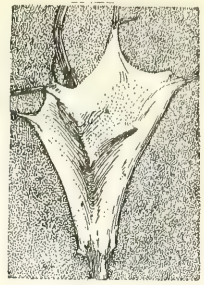
Leaf Spot—Becomes common on the leaves, first showing as small brownish-purple spots; when abundant causes the leaves to turn yellow and drop off prematurely; in wet seasons often serious. No efficient remedy. Mow early rather than late. If possible secure seed from disease free fields and when fields become badly infected start new ones.

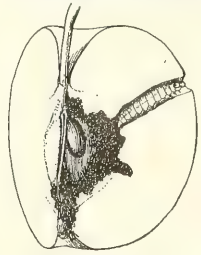
Insects, etc.

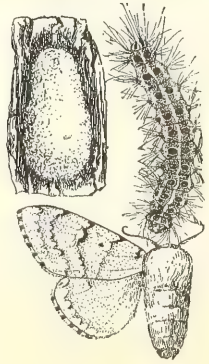
APPLE.

Bud-Moths: Case Bearers: Leaf Crumpler:—Small overwintering caterpillars feed upon the unfolding leaves. Spray with lead arsenate as soon as leaf buds begin to open. Repeat a few days later, if necessary. Rept. 1909, p. 353.

Canker-Worms—Small loopers devour the leaves in May and spin down on threads when disturbed. Spray with lead arsenate before blossoms open, and again soon after they fall. In unsprayed orchards place sticky bands around trunks of trees in October, keep sticky until January 1st, and again keep sticky during April and May. Rept. 1908, p. 777.







Tent-Caterpillar—During May the caterpillars form nests at the forks of the branches, and devour the leaves. Clip off and burn egg-masses on twigs in winter. Remove nests with caterpillar brush. Spray with lead arsenate once before blossoms open and again soon after they fall. Bull. 177, and Rept. 1913, p. 226.

Lesser Apple-Worm—Larva feeds on exterior of nearly mature fruit, and often causes injury in storage. Spray twice as for codling-moth. Keep foliage and fruit covered until fruit is nearly grown. Rept. 1910, p. 595.

Codling-Moth or **Apple-Worm**—Pink caterpillar tunnels inside the fruit, especially around the core. Spray with lead arsenate as soon as the blossoms fall. Repeat three and six weeks later. Rept. 1910, p. 594.

Brown-Tail Moth: Fall Web-Worm—See Pear.

Gipsy Moth—Brownish hairy caterpillars defoliate trees in May and June. Band trees with tanglefoot and spray foliage with lead arsenate. From August to May soak egg-masses with creosote. Bull. 186; Repts. 1905, p. 246; 1906, p. 235; 1907, p. 300.

Curculios—Grubs of both apple and plum curculios infest the fruit, making it gnarled and ill-shaped. Spray with lead arsenate as soon as blossoms fall, and again a week later.

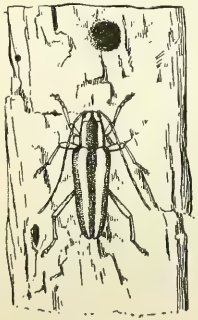
Repeat two weeks after blossoms fall. Destruction of early drops before July 1, from apple and neighboring peach, plum and cherry trees is important. Remove infested fruit in thinning. Keep fence rows clear of trash. Rept. 1904, p. 219.

Apple and Thorn Skeletonizer—Small spotted larvae feeding in web skeletonize upper surface of leaves. White pointed cocoons formed on leaves. Purplish moths fly about and rest on flowers. Three broods each season. Unsprayed apple trees brown in June and August. Spray with lead arsenate middle of May, first of July and middle of August. Rept. 1920, p. 190; 1921, p. 186; Bull. 246.

Green Fruit Worms: Palmer Worm: Leaf Roller—Caterpillars all feed upon foliage and immature fruit. Spray with lead arsenate, as for codling-moth.

Tussock Moths—Tufted caterpillars of several species feed upon the leaves in mid-summer. Spray with lead arsenate as for codling-moth. Rept. 1905, p. 230; 1907, p. 332; 1916, p. 105; 1917, p. 325.

Yellow-necked Caterpillar: Red-humped Caterpillar—Feed in clusters and often strip young trees in fall. Hand-picking is easy method of control. Spray leaves with lead arsenate. Rept. 1901, p. 274; 1917, pp. 328, 329.



Maggot or **Railroad Worm**—Maggots tunnel through the pulp of the ripening fruit of sweet and sub-acid varieties, especially those ripening early in the season. Destroy all infested fruit. Spray as late as July 15 with lead arsenate to kill adult flies. Rept. 1910, p. 593.

Round-Headed Borer: Flat-Headed Borer—Grubs burrow in wood at base of trunks. Watch trees and dig out borers wherever sawdust appears. Paint trunk with lead arsenate and lime-sulphur. Rept. 1907, p. 333.

Leafhoppers—Whitish insects sucking sap from under side the leaves. Spray with nicotine solution, as for aphids.

Tarnished Plant Bug—Injures developing fruit by sucking sap, forming dimples. Spray or dust with nicotine as for aphids.

Red Spider: Clover Mite: European Red Mite—Cause much injury to leaves, especially in dry seasons. Overwintering eggs killed by spray of miscible oils about April 1st. Spray in May and June with lime-sulphur or strong soaps.

Leaf-Blister Mite—See Pear.

Green and **Rosy Aphids**—Green aphids suck sap from the leaves and terminal shoots, causing leaves to curl and checking growth. Rosy aphids infest fruit clusters, checking development. Use delayed dormant spray with nicotine solution (½ pint in 50 gallons water), either separately or with lead arsenate, lime-sulphur or Bordeaux mixture. Dust with nicotine. Repts. 1903, p. 259; 1909, p. 343.

San José Scale—See Peach. Spray dormant trees with lime-sulphur or miscible oil. Bull. 165; Rept. 1904, p. 221.

Red Bugs—Two species of red leaf bugs suck the sap, causing leaves and fruit to become distorted. Spray with nicotine solution, as for aphids, or dust with 2% nicotine. Rept. 1917, pls. II-III.

Woolly Apple Aphis—A bluish-white, cottony plant louse in colonies on bark, forming galls or swellings on twigs of small trees, and preventing wounds from healing; also on roots, forming galls, and destroying

small feeding roots. Plant only clean or fumigated stock. Soak soil with carbon disulphide, ½ ounce in 4 gals. water. Spray above ground with kerosene emulsion.

Oyster-Shell Scale: Scurfy Scale—Scale insects with elongated or pear-shaped shells, on bark, suck sap from the twigs; the former about the same color as the bark, the latter light gray or whitish. Spray with nicotine solution; soap and water; or kerosene emulsion, about the second week in June. Bull. 143; Rept. 1903, p. 225.

Fungi, etc.

Baldwin Spot—Shows as small diseased masses of brownish tissue, usually a short distance beneath the skin; finally may appear at the surface as small, discolored, shrunken areas, then very similar in appearance to some of the fruit speck troubles. Not a fungous disease. Thought by some to be due to unusual local loss of water; similar troubles may start from punctures of rosy aphids or other puncturing insects. No definite remedy known; spray to keep down sucking insects.

Cankers—Occur on branches and are caused chiefly by European canker fungus which eventually forms a cavity surrounded by concentric elevated rings of wood extending to bark. Cut off infected branches, or cut out infected wood and bark; paint over cut surfaces. Keep orchard well sprayed and trimmed. Rept. 1903, p. 299.

Black Rot—Causes mature fruit to turn brown, then black; forms small brown spots on leaves; does some damage through cankers on branches, which are eventually killed. Treat as for scab; prune and burn all dead limbs and twigs; cut out and paint over large cankers when found. Rept. 1909-10, p. 590.

Fruit Specks—Appear as more or less numerous, small, brown or black spots, starting at surface of fruit and slowly working inward; the Brooks fruit spot often has a pinkish border in light-skinned varieties. Usually controlled by the late sprayings in June and July. Rept. 1909-10, p. 590.

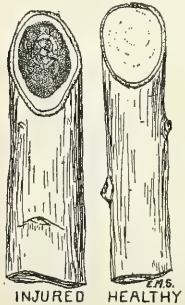
Rust—Shows as orange-colored blotches on leaves, eventually producing minute fringed clustered cups imbedded on the under side; less frequent on fruit. Rust spreads to the apple from the **cedar-apples,** which appear in the early spring on the red cedar. All cedars near the orchard should be destroyed. There is great difference in the susceptibility of different varieties to this disease. Spraying is only partially successful in this state. Repts. 1891, p. 161; 1909-10, p. 591.

Scab—Produces "scabby spots" on fruit and leaves; rarely on twigs. Give the pre-pink and pink sprays before the blossoms open, another after the petals fall, and follow with one, two, or more, at intervals of three weeks. For first treatment, use strong Bordeaux, for others, weak Bordeaux or lime-sulphur or better still the latter for all treatments. Rept. 1909-10, p. 591.

Sooty Blotch—Forms on fruit an olive-black superficial growth in distinct round colonies, often merging together. Spray as for scab, with lime-sulphur, 1½ to 50. The sprayings after blossoming, as for the fruit specks, are the more important. Rept. 1909-10, p. 592; 1911, p. 367.

Blight—See Pear. Not so serious on apple in this state as on pear. Doubtful if control measures for apple are practical here in most cases.

Spray Injury—Takes the form usually of burn on leaves and russeting on fruit. Is most likely to occur after later sprayings. Worst in wet seasons with Bordeaux and in warm seasons with lime-sulphur. Drenching the trees with high pressure apparatus is apt to produce injury. Spraying in bright sunshine may cause some scorch on fruit on sunny side. Varies greatly with different sprays. Avoid those known to be injurious or injurious combinations (as soap and lead arsenate); use Bordeaux if at all only for **first** summer treatment or on varieties not especially subject to russeting. Liquid or dry lime-sulphur is now the fungicide most commonly used on apples in this state. Rept. 1911, p. 360.



Winter Injury—Takes various forms from different conditions, such as: imperfect fertilization or russeting of fruit following late spring frosts; sun scorch of trunks due to mild winter weather followed by sudden cold; bud and twig killing, frost cracks in trunks, blackened wood, dead roots, etc., following unusually cold winters or unfavorable environment. Set out only hardy varieties; avoid planting in wet ground or on hillsides with extreme south or southwest slopes. Head trees low; avoid late fertilization and cultivation; keep earth tight around trunks; use cover crops. Repts. 1903, p. 303; 1906, p. 310; 1914, p. 6.

Storage Rots—Are troubles caused by a variety of fungi. Store fruit, in a dry condition, in a cool, well-aired place. Do not store in too deep piles or too tight receptacles. Use poorer keeping varieties first, and sort over if necessary. Apples from well sprayed trees keep best. Rept. 1915, p. 426.

General Treatment for Apple Orchards.

For the general control of fungi and insects on apples in Connecticut we make the following recommendations:

(1) Dormant (winter) treatment is necessary in the presence of red mite, San José scale and leaf blister mite. Use liquid lime-sulphur 1-9, or miscible oil 1-15; the latter is necessary for red mite control. The lime-sulphur is best used just as the leaves begin to show ("Delayed Dormant") as it then kills many aphids and may lessen scab infection. Miscible oil must not be applied later than when buds begin to swell or injury will result.

(2) Make at least three summer treatments with a fungicide and insecticide as follows:—

1. Pink spray, when blossom buds show pink.
2. Calyx spray when petals fall.
3. Young fruit spray three to four weeks later.

For scab control a pre-pink treatment is necessary to be applied between delayed dormant and pink. For control of sooty blotch, Brooks' fruit spot and often scab an additional treatment three to four weeks after No. 3 is required. This treatment is also necessary to control apple maggot, late codling moth and green fruit worms. The calyx spray is the most important to control codling moth.

(3) For a fungicide we recommend liquid lime-sulphur at the rate of 1¼ to 1½ gallons to 50 gallons of water, or dry lime-sulphur at the rate of 3 lbs. to 50 gallons of water, for all summer treatments. In case of severe scab infection Bordeaux mixture 1-4-50 may be used at the pre-pink and pink sprays without much danger of injury to the fruit but this practice is not in general use. In case one desires to dust, a sulphur dust is preferable to a copper dust.

(4) For the insecticide in the above, use lead arsenate, if in the paste form at the rate of three pounds per fifty gallons of the mixture, or if in the powder form one and one-half pounds per fifty gallons.

(5) If canker worms, tent-caterpillars, bud moths or brown-tail moths are causing damage, add lead arsenate to the first summer treatment; if not it may be omitted but should be included in each of the later treatments. Nicotine solution may be added to the pre-pink treatment for aphids and to any of the subsequent treatments to destroy aphids, red bugs, tarnished plant bugs, etc.

ARBOR-VITAE.

Insects.

Leaf-miner—The larva of a small moth mines the leaves causing them to turn brown. Spray heavily with nicotine sulphate solution the first week in June to kill adults and their eggs. Rept. 1921, p. 157.

Fungi, etc.

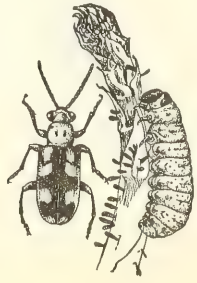
Browning—Shows especially through the older inner leaves turning brown and falling prematurely in late summer or fall. As there often remain only the leaves of the current year's growth the tree eventually presents a scanty healthy foliage; the brown leaves before they drop give the appearance of a serious fungous disease. Due to dry summers followed in some cases by winter injury. Not a progressive trouble and so finally not usually serious.

ASH.

Fungi.

Anthracnose—Causes large brown areas to appear suddenly in late spring or early summer on the leaves which may soon wither up much as if sun scorched. Usually infrequent. If feared, spray as for anthracnose of sycamore.

Rust—Occurs commonly on blades and petioles of leaves, and less frequently on the green twigs and fruit, as small cluster-cups filled with orange spores. The plant tissues are often swollen and distorted. Variable in its occurrence, sometimes prominent and wide-spread and the next year or two possibly infrequent or absent. Said to spread to ash from other spore stage on marsh grass. No efficient control methods, but causes little permanent injury to the trees.



ASPARAGUS.

Insects.

Asparagus Beetles, Common and **12-spotted**—Adults and larvae devour the foliage. Cut everything clean during the cutting season; afterward spray with lead arsenate and calcium caseinate. Rept. 1921, p. 171.

Asparagus Miner—Larvae tunnel under epidermis of stem near base, causing premature death of plant above ground. Burn infested stalks. Rept. 1906, p. 303.

Fungi, etc.

Frost Rot—Shows as rotting shoots here and there in the field, which have been previously injured by severe late frosts. Nothing need be done as the trouble is not progressive despite the presence of fungi causing the final decay.

Rust—Produces small reddish or black elongated pustules scattered over stems. In fall, carefully gather and burn all stems from affected beds and escaped plants in vicinity. In gathering for market cut below the ground, as protruding stems offer opportunity for development of first stage of the fungus. Spraying with resin Bordeaux partially controls the disease, but is seldom practiced now. Begin spraying the latter part of July and repeat about every 10 days until the middle of September. Thorough cultivation and fertilization, with plenty of humus in the soil, are advocated as beneficial. Grow varieties most resistant to the disease. This disease is not so serious as it was some years ago partly because more resistant varieties are now grown. Repts. 1896, p. 281; 1904, p. 313.

ASTER.

Insects.

Blister Beetles—Three or four species feed upon the flowers, the black one being commonest. Hand-pick and cover choice plants with mosquito netting. Bull. 208, p. 110.

Fungi, etc.

Yellows—Shows in the yellowed and often imperfectly developed foliage and one-sided blossoms. A physiological trouble; the cause is not definitely known. Buy best seed; transplant only healthy plants; have soil conditions good; keep down leafhoppers. Repts. 1903, p. 306; 1914, p. 413 (26).

BARLEY.

Insects.

Army Worm—See Grass.

Fungi.

Rusts—See Oats and Wheat.

Smuts—Are of two kinds, covered and loose, both largely destroying the infected spikes and changing them into black, sooty structures, in the latter kind easily dissipated. Treatment, see Oats. Rept. 1903, p. 306.

BEAN.

Insects.

Green Clover Worm—Occasionally green, wriggling caterpillars riddle the leaves in June and July. Dust string beans with air-slaked lime or other fine powder. Spray shell beans with lead arsenate. Repts. 1908, p. 828; 1919, p. 165.

Weevils—Adults lay eggs in the pods in the field and continue to breed in the dried seed, finally rendering it unfit for food or for planting. Fumigate the seed with carbon disulphide as soon as harvested, store in air-slaked lime, or heat in oven for 1 hour between 120° and 150° F. Bull. 195, p. 6.

Fungi, etc.

Anthracnose—Shows on leaves and pods as roundish discolored areas, often with a purplish border. Save seed from pods showing no spots and plant these by themselves, selecting each year seed from unspotted pods for the seed crop and using remainder for general crop. Destroy all infected seedlings. Where very troublesome spray with Bordeaux, beginning when plants are only a few inches high and repeating about every 10 to 14 days until pods are formed. Rotation and destruction of old vines may prove helpful in keeping the trouble in check.

Blight—Appears much like anthracnose, but with discolored areas having more of a translucent or watery character. Treat same as for anthracnose. Repts. 1898, p. 262; 1903, p. 307.

Downy Mildew—Forms dense, white, woolly growths on pods and less luxuriantly on young stems and leaves of the Lima bean. Serious only in years unusually moist after the middle of July. Plant on well-drained soil. Spray with Bordeaux beginning about the middle of July, and repeat every 10 to 14 days until the middle of September. Rept. 1905, p. 278.

Rust—Produces small, round, reddish or black, dusty outbreaks, usually on the leaves. Plant varieties not likely to rust. Burn the old infected plants in the fall, or rotate. Rept. 1903, p. 308.

Insects.

BEET-CHARD.

Leaf-Miner—A small fly lays eggs in the leaves, and the larvae tunnel or mine between upper and lower surfaces. Practice clean cultivation. Destroy all infested leaves. Destroy all plants of the weed known as "lambs quarters" in which this insect breeds. Practice late fall plowing.

Fungi.

Leaf Blight—See Mangel. Rept. 1903, p. 309.

Eelworms.

BEGONIA.

Leaf-Blight Eelworm—Produces conspicuous dead areas on the leaves of Begonias (especially var. *Cincinnati*), ferns, etc. Spots vary in size and shape according to host and disposition of larger veins. Buy healthy stock only; keep infected plants by themselves and give them plenty of room; keep leaves as dry as possible and pick off and burn worst infected. Rept. 1915, p. 455.

Insects.

BIRCH.

Tussock Moths—See Apple, Hickory, and Horse Chestnut.

Birch Leaf-Skeletonizer or **Birch Bucculatrix**—Small greenish-yellow larvae feed upon both sides of the leaves in late summer, often entirely defoliating the trees. Spray with lead arsenate (about August 1). Rept. 1910, p. 701.

Birch Leaf-miner—Sawfly larvae mine the terminal leaves of gray birch causing them to turn brown. There are three annual generations and a partial fourth, in Connecticut. Control not investigated. Rept. 1924, p. 340.

Bronze Birch Borer—Grub makes spiral tunnel just beneath bark of upper main branches, ridges showing on outside. Cut and burn infested trees before May 1. Spray foliage with lead arsenate about June 1, and fertilize and water the trees. Rept. 1922, p. 359.

BLACKBERRY.

Insects.

Blackberry Crown Borer—Larva tunnels in roots and at base of stem. Dig out and destroy.

Red-Necked Cane Borer—Larva tunnels in canes causing an irregular swelling or gall, often three inches in length. Cut and burn all infested canes in winter or early spring.

Blackberry Sawfly—Larvae devour leaves in June and first part of July. Spray with lead arsenate when young larvae appear. Rept. 1912, p. 236.

Fungi, etc.

Crown Gall—Forms hard galls or irregular excrescences on roots and lower parts of stem. Dig out and burn affected plants as soon as discovered. Never use infected stock for transplanting. A bacterial trouble. Rept. 1903, p. 354.

Leaf Spot—Shows on leaves as small circular spots with whitish center and purplish border; also occurs on dewberry and raspberry. Not usually serious, but where necessary it can be controlled by Bordeaux applied to the leaves, beginning before they have reached their full size. Rept. 1903, p. 309.

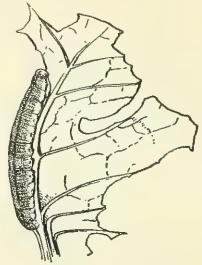
Orange Rust—Breaks out in spring or early summer as dusty masses of bright orange spores over the under side of the leaves. The fungus is perennial in the underground parts. Dig up and burn infected plants. Rept. 1903, p. 309.

Insects.

BOX.

Leaf-Miner—A small two-winged fly lays eggs in the leaf and the larvae tunnel between the upper and lower surfaces. Destroy infested leaves. Spray under side of leaves with molasses, 1 part in 3 parts water.

Oyster-Shell Scale—See Apple.



CABBAGE-CAULIFLOWER.

Insects.

Cabbage Worm—Green worms feed upon leaves all through season. Spray or dust unheaded plants with lead arsenate using calcium caseinate in the spray. Use insect powder or hellebore on headed plants. Bull. 190, p. 9; Rept. 1903, p. 271.

Cabbage Looper—Smooth looping caterpillars feed with cabbage worms late in summer, and require same treatment. Bull. 190, p. 12; Rept. 1910, p. 706.

Cabbage Aphis—Sucks sap from the leaves. Make heavy applications of nicotine dust. Bull. 190, p. 14; Rept. 1924, p. 319.

Cabbage Maggot—Infests stems of early-set plants near surface of ground, checking growth and often killing them. Practice crop rotations. Place hexagonal tarred paper disks around stems at setting time. Treat with carbolic acid emulsion or with corrosive sublimate. Bull. 190, p. 3; Repts. 1908, p. 832; 1914, p. 142; 1915, p. 114.

Fungi, etc.

Bacterial Leaf Spot—Shows as small, blackish, angular spots or specks on the leaves especially of the cauliflower. When abundant causes yellowing and premature death of the infected leaves. Watch the seed beds for signs of infection. If prominent in the field, next year treat the seed (see Black Rot) and spray the seedlings with Bordeaux mixture.

Black Leg—Causes cankered and finally black areas especially at base of the stem of young plants which later in the field often rot off or fail to make heads. Select only apparently healthy seedlings for transplanting and if this fails treat as for Black Rot another year.

Black (Bacterial) Rot—Forms black lines in veins of leaves. In time leaves turn yellow and easily drop off, and interior of head develops a general soft rot. As the germs can be carried on the seed, avoid seed from infected fields. If in doubt, treat seed in formalin, 1 part to 240 of water for 15 minutes. Keep refuse from diseased plants out of manure; practice rotation; make seed bed in new soil if disease appears in old one. Rept. 1912, p. 345.

Club Root—Causes knob-like enlargements on the roots of cabbage and allied plants. The germ often becomes established in the soil; avoid such land and the use of refuse from old plants on the soil. Be especially careful that the seed bed is not infected. Infected land, if used, should be treated in the fall with lime broadcast at the rate of 80 bushels per acre and worked in. Rept. 1903, p. 310.

Soft Rot—See Salsify. Rept. 1903, p. 311.

CARNATION.

Insects.

Green Fly or **Aphis**—Sucks sap from young leaves and buds. Fumigate greenhouse with tobacco, or spray with nicotine solution and soap, or with soap and water.

Fungi.

Leaf Mold and **Leaf Spot**—Are two troubles much alike in appearance, producing grayish spots with colored borders on stem, leaves and calyx. Treat as for Rust.

Rust—Produces small dusty pustules, more or less confluent, on the leaves and stems. Select rust-resisting varieties. Spray in field with Bordeaux, adding spreader. Select for transplanting only hardy and rust-free specimens. Keep air of greenhouse dry. Give one or two sprayings with Bordeaux, after transplanting in greenhouse; for repeated sprayings use potassium sulphide or weak copper sulphate. Rept. 1903, p. 312.

Stem Rot and **Wilt**—Cause the lower leaves first to turn yellow and dry up; then the stem gradually rots off at its base. Select cuttings only from perfectly healthy plants, and start these in sterilized soil and replant out of doors in new land, avoiding excessive use of manure. If disease appears after setting out in the greenhouse, pull up infected plants upon appearance of first symptoms, make liberal application of lime, avoid over-watering, and see that roots are properly aerated. Repts. 1897, p. 175; 1903, p. 312.

CEDAR.

Insects.

Web-Worm—Small brown caterpillars feed upon the leaves which they web together. Spray with lead arsenate.

Fungi.

Cedar-Apple Rust—Appears in spring as conspicuous rounded galls with jelly-like horns bearing spores that carry the fungus to apple and related hosts. Cut off and burn all *cedar-apples* if undesirable to destroy the trees. See Apple Rust.

CELERY.

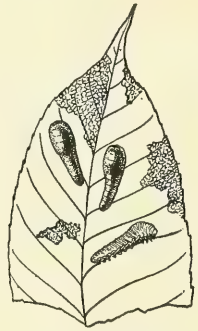
Insects.

Celery Caterpillar—Feeds upon the leaves of celery, parsley, fennel, carrot and parsnip. On the latter two plants lead arsenate may be used. On celery and parsley hand picking is perhaps the best remedy. Rept. 1920, p. 204.

Fungi, etc.

Early and Late Blight—Two diseases showing "rusty" spots on leaves; the latter trouble distinguished by the very minute black dots in the discolored spots (fig.) and often progressing in stalks after storage. Spray the plants thoroughly in the seed bed with Bordeaux, as infected plants are a means of introducing the trouble in the field. Continue the spraying after transplanting at intervals of about two weeks up to the last of September. Some use copper dust instead of the spray. Before covering for bleaching, if leaf spot is abundant give final treatment. Rept. 1897, p. 167.

Soft (Heart) Rot—Shows as a soft rot of the tissues often confined to the heart. Do not plant in too wet soil; avoid land with green cover crops recently plowed in; in banking allow for proper aeration. See Salsify. Rept. 1914, p. 10.



CHERRY.

Insects.

Cherry or **Pear Slug**—Larvae eat away the green tissue from upper side of leaf. Spray or dust with lead arsenate and sulphur. Rept. 1920, p. 199.

Canker-Worms—See Apple.

Cherry Maggots or **Fruit Flies**—Larvae of two species infest maturing fruit. Sprinkle foliage with sweetened lead arsenate in early June to kill the adult flies.

Plum Curculio—See Plum.

Cherry Aphid—A brown aphid which sucks sap from under side of leaves, causing them to curl. Spray with nicotine solution and soap, soap and water, or kerosene emulsion.

Fungi.

Black Knot—Forms knot-like growths on twigs and branches. Plant only trees free from this trouble; in the orchard, cut off and burn all infected branches in late fall or winter, painting over large cut surfaces. Cutting *out* knots is not advisable, as new outbreaks usually result. In cutting off, cut several inches below the knot, to insure removal of diseased tissues. Remove all knots each year until they fail to reappear. Spraying in spring and early summer with self-boiled lime-sulphur or Atomic Sulphur helps to keep new knots from fruiting, but is

entirely secondary in importance to the removal of the knots. Rept. 1911, p. 399.

Brown Rot—See Plum. Rept. 1911, p. 402.

Anthracnose—Shows as numerous, closely placed, purplish spots on leaves, which often have "shotholes." Spraying, if begun on young leaves early in May, is effective. Use self-boiled lime-sulphur or Atomic Sulphur. Give four or five sprayings at intervals of two weeks. Repts. 1895, p. 188; 1911, p. 401.

Powdery Mildew—Develops a cobweb-like growth over the leaves. Usually worst in young trees; controlled by spraying.

CHRYSANTHEMUM.

Insects.

Black Fly or **Aphis**—Sucks the juice from the young leaves and flower stems. Fumigate the house with tobacco; dip the plants in or spray them with soap and water or nicotine solution and soap.

Gall Midge—Larvae form cone-shaped galls on leaves and new shoots. Spray plants about three times each week with nicotine solution and soap. Rept. 1919, p. 161.

Leaf Mite—See Cyclamen.

Fungi.

Powdery Mildew—Develops as a white mealy or cobweb coating on leaves. Air and water carefully, and if necessary spray from time to time with potassium sulphide or paint heating pipes with sulphur.

Rust—Appears as dusty reddish-brown outbreaks, about the size of a pin head, chiefly on under sides of leaves. Avoid susceptible varieties. Start with cuttings free from rust. Destroy rusted leaves, especially on young plants. Early sprayings with dilute copper sulphate or potassium sulphide may help to prevent the trouble from getting a start. Rept. 1903, p. 315.

CINERARIA.

Insects.

Aphis or **Green Fly**—Sucks sap from the leaves and stems. Use nicotine solution and soap, or soap and water, as a spray or dip.

CLOVERS.

Insects.

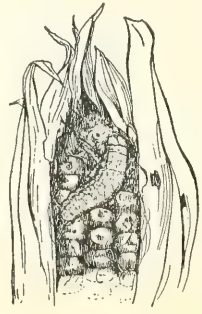
Aphids—See Alfalfa.

Fungi.

Powdery Mildew—Appears as a white, somewhat powdery coating over the leaves, especially of red clover, in its summer spore stage only. Recently a wide-spread disease over eastern United States. While common in this state usually not serious as it appears most frequently on escaped plants or secondary growth. As yet no practical control measures.

CORN.

Insects.



Cut-Worms—See Tomato.

Army Worm—See Grass.

Stalk Borer—See Dahlia.

White Grubs—See Grass.

Corn Ear Worm—Eats the immature kernels at the end of the ear. Dust the silk with equal parts sulphur and powdered lead arsenate. Rept. 1921, p. 165.

European Corn Borer—Imported into eastern Massachusetts, New York and Canada and has been found at a few points along

the Connecticut coast. Clean-up measures taken. Larvae tunnel in all parts of plant above ground. Destroy all infested plants. Send suspected material to Station. Repts. 1918, p. 316; 1923, p. 277.

Fungi.

Leaf Blight—Kills parts of the leaves in August and September much like an early frost. Most injurious in wet late seasons. Plant early maturing varieties and stimulate growth by good fertilization and cultivation. Rept. 1903, p. 317.

Root and **Ear Rots**—Injure roots and base of stalk with a reddish-brown rot. Stalks are easily broken off and often fail to produce ears. The ears show moldy, white or pinkish growths. Plant only vigorous disease-free seed, practice yearly rotation and do not let corn follow other grains. Bull. 222, p. 427.

Smut—Forms black dusty outbreaks on various parts of the plant. It is especially injurious to certain varieties of sweet corn. Seed treatment is ineffective.

CRANBERRY.

Insects.

Fireworm or **Black-headed Cranberry Worm**—Small, pale green, black-headed caterpillars web the leaves and new shoots together and feed inside the nest. Spray with lead arsenate to kill the caterpillars. Flood the bog for three days to kill the pupae.

Yellow-headed Cranberry Worm—Small, green yellow-headed caterpillars injure plants in same manner as the preceding. Spray with lead arsenate. Keep bogs flooded until about May 20.

Cranberry Fruit Worm—Pale green larvae infest the berries. Flood the bog for about two weeks as soon as the fruit has been harvested. Destroy all infested berries.

CUCUMBERS.

Insects.

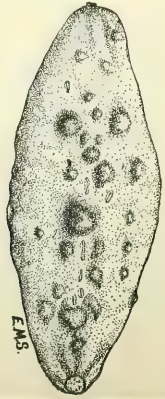
Striped Cucumber Beetle—Attacks young plants, eating the leaves. Larvae infest the main root or stem under ground, often killing the plant. Dust leaves with dry lead arsenate. Cover plants with screens. Bull. 216, p. 34; Rept. 1908, p. 807.

Melon Aphid—See Melon.

Fungi, etc.

Anthracnose—Produces prominent discolored spots, more or less merged, on leaves; occurs as rot on fruit. More serious on watermelon. Treatment is the same as for mildew.

Downy Mildew—Forms discolored spots as in preceding, with fungous growth on lower side. Repeated sprayings with Bordeaux every 10 to 14 days during the season, beginning at least by middle of July, usually keeps this disease in check. Rept. 1904, p. 329.



Mosaic and **White Pickle**—Are two very similar, if not identical, physiological diseases, showing in the former on the leaves as mottling of lighter or yellow-green areas scattered among the normally green tissues, and in the latter causing the fruit to become irregularly shaped, knobbed, and often mottled or whitish in color. Keep down sucking insects that may spread the disease, as it is infectious; pull up and destroy vines first showing it. Rept. 1915, p. 430.

Wilt—See Squash.

about May 28.

Insects. **CURRANT.**

Currant Fruit Fly—Small maggots infest the berries, which color prematurely and drop. Destroy infested fruit.

Currant-Worm—Devours foliage in May. Spray with hellebore or lead arsenate. Rept. 1902, p. 170.

Currant Borers—The larvae of two species of insects tunnel in the pith of the stems, causing the leaves to droop and wilt. Destroy infested canes during May.

Currant Stem Girdler—Adults cut or girdle tip of new shoots after laying eggs in them. Cut and burn these tips at any time of year. Rept. 1920, p. 201.

Currant Aphids—Yellowish-green aphids on under side of leaves, causing them to curl. Underspray with nicotine solution or kerosene emulsion, or apply nicotine dust.

Four-Lined Leaf-Bug—A yellow and black striped bug sucking sap from the leaves. Spray with nicotine solution and soap. Bull. 208, p. 118.

San José Scale—See Peach.

Scurfy Scale—A conspicuous pear-shaped light-gray scale on bark, the insect sucking sap from twigs. Spray about second week in June with kerosene emulsion or nicotine solution and soap. Bull. 143; Rept 1903, p. 227.

Fungi.

Anthracnose and **Leaf Spots**—Cause spots on the leaves and usually their premature shedding; the former also spots the fruit of certain varieties. Spray with Bordeaux as the leaves unfold, and repeat at intervals of 10 to 14 days until the fruit begins to ripen. If necessary continue spraying after harvest. Rake up and burn leaves in fall.

Blister Rust—Shows first as dusty orange-colored outbreaks about size of pinhead on lower surface of leaves, and later as short hair-like growths. Worst on black currants which should be destroyed, if infected, near white pines, the alternate host. Report presence to the Experiment Station. See Pine. Rept. 1911-12, p. 347.

Insects. **CYCLAMEN.**

Leaf-Mite—Transparent microscopic mites cause leaves to curl, and plants do not blossom. Syringe under leaf surface strongly with water. Spray with, or dip plants in, nicotine solution and soap, 1 part in 400 parts of water. Avoid excessive moisture in house. Rept. 1914, p. 176.

Insects. **DAHLIA.**

Tarnished Plant Bug—Sucks the sap from the stems and buds causing them to fall. Spray with nicotine solution and soap. Rept. 1904, p. 218.

Stalk Borer—Larva tunnels up and down inside the main stem, the top portion usually wilting and dying. Carefully make longitudinal slit in the stem and kill the borer. Bull. 208, p. 111; Rept. 1919, p. 180.

Insects. **EGG-PLANT.**

Flea Beetle—See Potato.

Colorado Potato Beetle—See Potato.

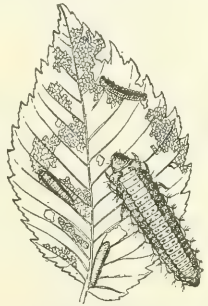
Fungi.

Fruit Rots—Caused by several fungi, the gray mold producing the most extensive rot. Spray with Bordeaux; pick off and carry away the rotting fruit.

ELM.

Insects.

Spiny Elm Caterpillar—Clusters of black spiny caterpillars often strip certain branches of elm, willow, and poplar. Remove and destroy entire cluster, or spray with lead arsenate. Rept. 1906, p. 260.



Elm Leaf Beetle—Adult beetles eat holes through the leaves in May, and in June and July the larvae or grubs eat away the green tissues from the under surface. Spray with lead arsenate early in May to kill egg-laying beetles, or spray under surface of leaves with same mixture about June 1, to kill the larvae. Yellow pupae at base of trees may be killed with kerosene emulsion or soap and water. Bull. 155; Rept. 1908, p. 815.

Canker-Worms—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Leopard Moth—Larvae tunnel in branches under the bark, cutting deep galleries, often girdling the branch, which later breaks off and falls to the ground. Small trees may be examined and borers killed by injecting carbon disulphide, or by inserting a wire. Bull. 169; Rept. 1911, p. 317.

Elm Scale—A large brown soft scale, oval in shape with cottony marginal fringe, located especially in the cracks of the bark of trunk and lower branches, sucking the sap. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 235.

White Elm Scale—A whitish pear-shaped scale on twigs. Spray about June 10 with kerosene emulsion.

Elm Woolly Aphids—Several species curl the leaves, or form in cottony masses on the bark. Spray with kerosene emulsion

Fungi.

Leaf Spot—Shows as black slightly elevated specks more or less thickly imbedded in the leaves, causing their premature fall. Not usually so injurious as to warrant the expense of spraying with Bordeaux which should start on the young leaves. Rept. 1909-10, p. 717.

EUONYMUS.

Insects.

Euonymus Scale—The various species of Euonymus are attacked and often injured by this scale, which has narrow white (male) or pear-shaped gray or brown (female) shells. Cut and burn infested twigs. Cover and fumigate with hydrocyanic acid gas. Spray with nicotine solution or kerosene emulsion during June to kill young. Rept. 1921, p. 185.

FERN.

Insects, etc.

Hemispherical Scale—Brown, oval convex scales on fronds of plants under glass. Apply soap and water or nicotine solution as a dip or spray. Bull. 151, p. 9; Rept. 1905, p. 239.

Leaf-Blight Eelworm—See Begonia.

GERANIUM.

Insects.

Greenhouse Leaf-Tyer—Small green wriggling caterpillars feed upon the leaves of plants under glass. Spray with lead arsenate.

White Fly—See Tomato.

Leaf Mite—See Cyclamen.

Fungi, etc.

Bacterial Leaf Spot—Shows as light or finally dark brown, semi-pellucid when wet, spots on the leaves, causing their premature death when abundant. Watch the propagating stock and start with disease-free cuttings; destroy first infected leaves; if necessary spray with Bordeaux mixture.

Gray Mold—Produces dead areas on leaves and blasts blossoms. Worst in poorly lighted and leaky greenhouses. Keep drippage off plant; avoid watering in cloudy or muggy weather; ventilate. Attacks as a semi-parasite a variety of greenhouse plants. Rept. 1903, p. 322.

GOOSEBERRY.

Insects.

Currant-Worm—Devours foliage. Apply hellebore or lead arsenate early in season. Rept. 1902, p. 170.

Gooseberry Fruit-Worm—Feeds inside the berry. Destroy infested berries.

Currant Fruit Fly—See Currant.

Fungi.

Mildew—Forms a felt-like growth on fruit and leaves of young shoots. Worst on European varieties; also attacks currants, especially young shoots. Spray with potassium sulphide or other sulphur spray as soon as buds break, and repeat about every ten days until the end of June.

Blister Rust—Not common as yet on cultivated varieties. See Currant. The cluster-cup rust is sometimes mistaken for this.

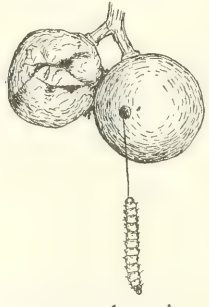
GRAPE.

Insects.

Grape Vine Flea Beetle—Adults and larvae devour the leaves. Spray with lead arsenate the latter part of June.

Rose Chafer—Long-legged brown beetles appear about June 15 and feed upon leaves, flowers and newly set fruit, often doing great damage. Cover choice plants with netting. Spray heavily with self-boiled lime-sulphur just before blossoms open and again after fruit has set. Rept. 1916, p. 111.

Grape Plume Moth—Small green spiny caterpillars web together the newly formed leaves at the tips of new shoots. Damage more apparent than real. Crushing by pinching these leaves is the best remedy. Rept. 1914, p. 190.



Grape Berry Moth—Larva feeds and develops inside the berries and is the cause of most wormy grapes. Spray with lead arsenate soon after the fruit sets, and repeat twice at intervals of about ten days. Bag the clusters soon after the fruit sets. Rept. 1920, p. 206.

Grape Root Worm—Adult beetles eat chain-like holes in leaves in July, and larvae or grubs devour the small feeding roots and eat channels in the bark of the larger roots and main stem underground, often causing great injury. Spray leaves with lead arsenate.

Sphinx and **Other Caterpillars**—Several species of horn worms as well as other kinds of caterpillars feed upon the leaves. Spray with lead arsenate or practice hand picking.

Grape Leafhopper—Small, yellow and red-marked leafhoppers sucking sap from under side of leaves. Spray under surface with nicotine solution and soap.

Grape Phylloxera—Sucks sap from roots and leaves, forming galls, and causing serious injury to European varieties. Graft on native species.

Fungi.

Black Rot—Causes reddish-brown spots on leaves; more rarely on stems; rots the berries, which finally become hard, shrunken and black. This is one of the worst diseases of the grape and often difficult to control by spraying. Begin spraying before blossoming time, about the last of May, with second application just after blossoming and subsequent sprayings at intervals of about 10 to 14 days. Usually 4 or 5 sprayings with Bordeaux are sufficient. Repts. 1889, p. 174; 1890, p. 100.

Downy Mildew—Develops, usually, dense white fruiting patches on under side of leaves and more or less discoloration on the upper; occurs somewhat on stems and fruit. With white varieties, like Niagara, may retard maturity, the occasionally infected berries of the bunch remaining hard, white specked, or shelling off prematurely. Treat as for black rot, omitting first treatment. Rept. 1893, p. 77.

Gray Mold—Causes rotting of ripening greenhouse grapes, covering them with a more or less conspicuous grayish mat of fruiting threads. Remove rotting grapes from the house. Use care in ventilating and watering. If necessary spray bunches several times with potassium sulphide.

Powdery Mildew—Produces a cobweb-like growth over upper surface of leaves; most conspicuous in the fall, when the minute, round, yellowish to black fruiting-bodies are found scattered over surface. Treat as for black rot. Potassium sulphide is also used effectively against this fungus. Rept. 1895, p. 185.

GRASS.

Insects.

White Grubs—White grubs are the larvae of June beetles, and when abundant in the soil and approaching maturity, cause much damage, especially in seasons following drought, by eating off the roots of grass, corn, strawberries, etc. Plow just before October 1 to expose insects. Harrow very thoroughly before planting. Repts. 1912, p. 288; 1915, p. 179.

Asiatic Beetle—Grubs of an introduced species injure lawns in Westville. Drench with carbon-disulphide emulsion in September or May when grubs are near surface. Calcium cyanide 4 oz. per sq. yard, watered in will kill grubs but also injures grass. Repts. 1923, p. 291; 1924, p. 294.

Fall Army Worm—Attack similar to that of army worm but occurs in September instead of July, and is more apt to be confined to lawns and millet. The worms do not migrate in such great numbers from one field to another. Same remedies apply. Also practice late fall plowing. Rept. 1912, p. 284.

Army Worm—In certain seasons grasses and grains are stripped of leaves and heads during July by brown striped caterpillars, which when abundant move like armies from one field to another, often causing great damage. Spray with lead arsenate, strips of grass or grain to protect fields not attacked. Plow deep furrows across line of march, turning the furrows towards the line. Sprinkle migrating worms with kerosene. Use poisoned bran mash. Rept. 1914, p. 157.

Fungi.

Brown Spot—Caused by a soil fungus that rots off the stems and roots near the surface, the parts above turning brown and dying. Usually starts in small circular spots in lawns in wet seasons. Do not confuse with similar injury due to severe winters and summer droughts. Spray infected spots and adjacent grass every week or two, according to weather, with Bordeaux mixture until spots fail to spread further.

HICKORY.

Insects.

Fall Web-Worm—See Pear.

Walnut Caterpillar—See Walnut.

Hickory Tussock Moth—White and black hairy caterpillars feed upon the leaves in late summer. Spray with lead arsenate. Repts. 1907, p. 332; 1917, p. 325.

Hickory Bark-Beetle—Small black beetles breed under bark and the galleries soon girdle the tree. Adults emerge, leaving numerous round holes as if the bark had received a charge of bird shot. Beetles also feed at base of compound leaf stems, causing them to break and fall in midsummer. Has killed thousands of trees in Atlantic States. Badly infested trees should be removed before May 1, and burned, or at least the bark removed. Spray healthy and slightly infested trees about June 1, with strong lead arsenate and nicotine solution. Repts. 1901, p. 267; 1914, p. 198.

Hickory Borer—Larvae tunnel deep into solid wood of trunk. Hunt for sawdust, find the burrow, inject carbon disulphide, and plug the entrance.

Hickory Gall Aphid—Curious galls on the leaf stems often cause the leaves to fall in midsummer. Galls contain large number of aphids. Spray with nicotine solution just as new growth starts in spring. Rept. 1916, p. 145.

HOLLYHOCK.

Fungi.

Rust—Appears as small, compact, reddish-brown pustules on both leaves and stems. In late fall, cut off the plants close to the ground, and destroy them. Spraying with Bordeaux is helpful in checking the rust; begin as plants push through the ground. Rept. 1895, p. 188.

HORSE CHESTNUT.

Insects.

White-Marked Tussock Moth—Tufted caterpillars devour leaves in midsummer. Spray with lead arsenate. Repts. 1905, p. 230; 1916, p. 105.

Fungi.

Leaf-Spot—Shows as extended reddish-brown areas on the leaves, resembling sun scorch, but showing the fruiting stage as minute black dots in the dead tissues. This trouble can be controlled by spraying with Bordeaux. The first application is made on the unfolding leaves and is followed by two or three at intervals of about two weeks.

HORSE RADISH.

Insects.

Flea Beetle—Adults feed on the leaves, and larvae tunnel in the petioles. Spray with Bordeaux mixture and lead arsenate.

IRIS.

Insects.

Iris Root Borer—Larva tunnels in the rootstocks, injuring many plants. Destroy infested rootstocks. In bad infestations burn over the beds in winter to destroy the eggs. Repts. 1915, p. 189; 1918, p. 331.

Fungi, etc.

Leaf Blight—Occurs as elliptical spots with purplish border; if abundant causes leaves to turn yellow and die prematurely; is worst on German Iris. Keep foliage coated with Bordeaux or lime-sulphur, beginning early; gather and burn infected rubbish in late fall.

Soft Rot—Attacks rootstocks, destroying lower parts so that leaves turn yellow and die. Same bacterial disease is described under Salsify. Propagate only from healthy stock; plant in well-drained soil; use only well-rotted manure; prevent winter injury of roots. Rept. 1903, p. 327.

IVY, BOSTON.

Fungi.

Leaf Spot—Forms conspicuous brownish spots with purplish borders, which run together if abundant. It is the same as leaf stage of black rot of grape. Give several sprayings with commercial lime-sulphur, beginning on unfolding leaves. Burn leaves in fall.

KALE.

Insects.

Turnip Aphid—See Turnip.

Fungi.

Black Rot—Rept. 1915, p. 431. See Cabbage.

LARCH.

Insects.

Larch Sawfly—Larvae defoliate trees in midsummer. Spray with lead arsenate. Rept. 1915, p. 125.

Case Bearer or **Leaf Miner**—Small Lepidopterous larvae mine the leaves; pass the winter in cigar-shaped cases on the twigs. Dormant spray of lime-sulphur. Rept. 1923, p. 288.

Woolly Aphid—White cottony tufts on the bark and at the leaf whorls. Spray with kerosene emulsion or with nicotine sulphate solution and soap.

LARKSPUR.

Insects.

Mite—Curls leaves and buds of new growth which become swollen and distorted, often with a purplish color. Spray two or three times each week from first appearance until blossoms open, with nicotine sulphate, 1-400. Rept. 1914, p. 176.

Fungi, etc.

Bacterial Leaf Spot—Shows as purple-black, irregular, usually conspicuous spots on both surfaces of the leaves. Do not confuse with the mite injury described above. On first appearance pick off and destroy infected leaves. In fall cut off plants close to ground and carry away all rubbish.

LETTUCE.

Insects.

Aphid or **Green-Fly**—Sucks sap from leaves. Fumigate with tobacco or hydrocyanic acid gas. Spray with soap and water.

Fungi, etc.

Drop—Causes sudden wilting of plants by infecting and rotting off leaves at surface of soil; often shows a white moldy growth over the basal parts. This may develop into a serious trouble in the greenhouse, as the fungus often becomes established in the soil, when the best remedy is to change the soil entirely or sterilize it by steam or formalin (formula D). Treat some days before using. Rept. 1908, p. 863.

Head Rots—Are of two kinds in field lettuce—one a basal leaf rot, caused by the same soil fungus that injures lawns, invades the lower leaves in contact with the ground and rots these spreading upward; the other, a bacterial disease, begins at the margins of the leaves but often develops a serious rot more or less hidden within the apparently sound head. Very wet ground or weather is largely responsible for the appearance of either. Rapid growth favored by excess of humus in the soil promotes both. Avoid use of green manures. Keep top soil well dried out by shallow cultivation. Building-paper disks placed under individual plants might hinder infection from the first mentioned.

Leaf Mold and Mildew—The first produces a brownish and the second a white moldy growth in spots on the leaves. These diseases are usually held in check by sub-irrigation or care in watering and ventilating to keep plants and atmosphere as free from moisture as is consistent with good growth. Thoroughly spray young plants with Bordeaux, where feared.

LILAC.

Insects.

Lilac Borer—A white larva tunnels in the twigs. Cut and burn infested twigs. Rept. 1905, p. 260.

Oyster-Shell Scale—See Apple.

San José Scale—See Peach.

Fungi.

Powdery Mildew—Forms whitish cobwebby coating on leaves, with mature stage finally abundant as black dots. Conspicuous and common, but rarely demands preventive treatment by spraying.

LILY.

Insects.

Aphid—Yellow aphids with red markings, on under side of leaves. Spray with nicotine solution and soap.

Stalk Borer—See Dahlia.

LINDEN.

Insects.

Canker-Worm—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

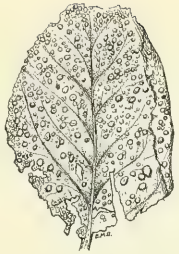
Linden Borer—A white larva tunnels in wood at base of trunk. Dig out borer, or inject carbon disulphide. Rept. 1915, p. 186.

LOCUST.

Insects.

Locust Borer—Larvae tunnel in solid wood of trunk. When new leaves appear, spray bark of trunk and larger branches with mixture made by dissolving ¼ lb. sodium arsenite in 5 gallons water to which 1 quart of miscible oil is added and the whole thoroughly agitated. Beetles will not lay eggs on shaded trunks, hence growing trees in thick stands or shading the trunks is effective.

MANGEL.



Insects.

Leaf Miner—See Beet.

Fungi.

Leaf Blight—Shows as grayish circular spots with purplish borders; when abundant causes premature death of leaves. Rotate; keep refuse out of manure piles; spray with Bordeaux before disease gets started. Rept. 1915, p. 432.

Root Rot—Rots off roots below ground, turning foliage yellow and often killing it. Not common, but injurious occasionally in low wet fields. Avoid wet ground; keep rotted plants out of manure. Rept. 1915, p. 433.

MAPLE.

Insects.

Maple Borer—Larva tunnels in spiral course upward around trunk or larger branches of sugar maple, working in sapwood and cambium, often girdling the trees. Examine trees in September for sawdust. Find the burrow, inject carbon disulphide and plug the opening. Rept. 1922, p. 351.

White-marked Tussock Moth—See Horse Chestnut.

Other Tussock Moths—See Apple.

Canker-Worms—See Apple.

Cottony Maple Scale—Large, oval, brown soft scales on bark of branches of silver and red maples. Each scale in early summer develops a large cotton-like tuft of wax, nearly half an inch long, and soon afterwards the young appear. Spray with miscible oils. Rept. 1921, p. 179.

Woolly Maple Leaf Scale—Cottony or woolly masses of wax, containing the females, eggs and sometimes larvae, appear on the under side of the leaves of sugar maples in midsummer; leaves fall prematurely. Males and larvae enter crevices of bark of trunk and branches; latter pass the winter. Attacks only sugar maples. Spray dormant trees with nicotine solution and soap. Do not use miscible oils. Burn all infested leaves. Bull. 151; Repts. 1905, p. 226; 1911, p. 345.

Terrapin Scale—Small reddish-brown soft scales on small twigs of silver and red maples, sometimes killing the branches. Spray with kerosene emulsion. Rept. 1921, p. 183.

Oyster-Shell Scale—See Apple.

Maple Aphids—Green aphids are common on under surface of leaves of Norway and Sycamore maples in June. Spray with nicotine solution and soap, or with kerosene emulsion.

Gall Mites—Disfigure leaves by forming galls on upper surface. Destroy infested leaves.

Fungi, etc.

Anthracnose—Causes dead areas in the leaves, often hard to distinguish from the leaf scorch. Its appearance depends on character of season. For this reason spraying is of doubtful value in the long run, but when given should start on the unfolding leaves. Repts. 1903, p. 329; 1915, p. 436, unusual form.

Black (Tar) Spot—Forms slightly thickened black spots on the leaves, resembling finger prints. Cut-leaf maples are especially susceptible. Rake up and burn all leaves in the fall. Rept. 1908, p. 852.

Leaf Scorch—Shows as more or less extended and irregular dead areas, appearing suddenly, usually from the leaf margins inward. A physiological trouble due to sudden or excessive evaporation beyond the supply of water furnished by the roots, which is in turn due to abrupt changes in atmospheric conditions, drought, injury to roots, etc. Pruning, when necessary, watering or mulching, and stimulating root growth by nitrogenous fertilizers are best remedial measures. Rept. 1905, p. 267.

Stag-head—Shows in trees killed at the top or by central branches gradually dying. Due to various agents or unfavorable environment such as parasitic or semiparasitic toadstools and shelf-fungi, escaping gas in soil, winter injury, etc. Cut off dead and dying branches; clean out decaying wood, treat with a wood preservative and fill cavities. Stimulate new growth by nitrogenous fertilizers.

MARGUERITE.

Insects.

Marguerite Fly or **Leaf Miner**—A maggot tunnels between upper and lower leaf surfaces. Spray every ten or twelve days with nicotine solution. Rept. 1915, p. 188.

MELON (MUSK).

Insects.

Melon Aphid—Sucks the sap from the under side of the leaves, and when abundant causes much damage. Underspray the leaves with nicotine solution and soap. Dust with nicotine. Bull. 216, p. 47; Rept. 1908, p. 813.

Striped Cucumber Beetle—See Cucumber.

Fungi.

Anthracnose—Appears occasionally. See Cucumber.

Downy Mildew—Causes angular, eventually brown spots in the leaves, often killing vines; most prominent just before melons ripen, later ones not maturing or worthless. Begin spraying with Bordeaux mixtures soon after the vines start to run, and keep them covered to the end of the season. In very wet seasons spraying is not entirely effective. Rept. 1904, p. 329.

Leaf Mold—Develops dead spots on the leaves very similar to those caused by downy mildew. Spray with Bordeaux on the first running vines and repeat every 10 to 14 days, making 4 or 5 applications according to season. Repts. 1895, p. 186; 1898, p. 225.

Wilt—See Squash.

MILLET.

Insects.

Fall Army Worm—See Grass.

NASTURTIUM.

Insects.

Aphid—Brown aphids cluster on stems and leaves, sucking the sap. Spray with nicotine solution and soap.

OAK.

Insects.

Canker-Worms—See Apple.

Gipsy Moth—See Apple.

Brown-Tail Moth—See Pear.

Orange-striped Oak-Worm—Black and orange striped caterpillars feed upon the leaves late in summer. Spray with lead arsenate.

Fungi.

Anthracnose—Appears as light-brown spots on the young leaves, killing some before they unfold. Infection comes from spores produced in inconspicuous pustules on the young twigs. Treat as for anthracnose of sycamore.

Leaf Curl—Appears, not uncommonly on certain species of park and lawn oaks, as a dense violet-gray felt in cupped areas on under side of the leaves with the upper surface elevated and light colored. Without definite experience we recommend same treatment as for peach leaf curl, namely, a dormant spray with lime-sulphur, 1 to 9, just before buds begin to swell.

Heart Rots—Develop occasionally hoof-shaped or bracket fungi on trunks. Gain entrance through wounded and dead branches; cause rot of heart wood and sometimes slow death of sapwood and bark. Break off and burn fruiting bodies; cut out diseased bark and sapwood, and dig out infected heartwood; fill cavity if desired. Occur in other deciduous trees, especially maples. Bull. 222, p. 446.

OATS.

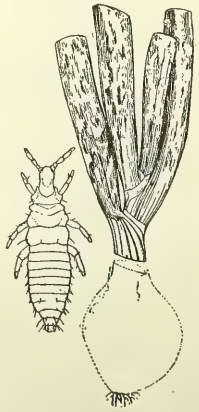
Insects.

Army Worm—See Grass.

Fungi.

Black Stem Rust—Forms, chiefly on leaf sheaths and stems, first the II stage as reddish pustules and later the III stage as elongated black outbreaks. Also occurs on wheat, rye, and other grasses as different strains. The I stage appears in spring on barberry leaves as cluster-cups, but the fungus can skip this stage. Quite serious in regions where grain is grown extensively, and difficult to control. This and several related species are becoming more important here as more grain of various kinds is grown. Cut out barberries in vicinity of fields.

Smut—Destroys the grain, turning it into a black dusty mass of spores. Seed treatment will prevent this smut. Either soak the seed 12 minutes in water at 133° F., and dry thoroughly, or sprinkle quickly with formalin (formula A), stirring the grain so that it is thoroughly wet, and leave in piles for several hours before drying out. A less cumbersome treatment coming into general use is that given under formula B. Buy seed from smut-free fields.



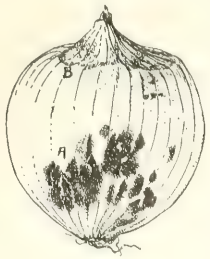
ONION.

Insects.

Thrips or **"White Blast"**—Very small insects which feed upon the surface of the leaves, giving the field a whitish appearance. Burn all tops and refuse; burn over the grass land around the field to kill overwintering insects. Spray with nicotine solution and soap, or kerosene emulsion. Repts. 1903, p. 266; 1913, p. 233.

Maggot—Infests the bulb of the young plant. Practice rotation of crops. Spray

plants here and there over the field with sweetened lead arsenate to kill the adult flies. Rept. 1911, p. 286.



Fungi.

Anthracnose (Black Spot)—Shows as black circular spots on the bulbs, usually on white varieties after storing. Store onions as dry as possible and keep barn dry and cool. Avoid piling too deeply in bins. Air-slaked lime mixed with sulphur scattered over them at time of storing may prove beneficial. See Stem Rot for treatment with formalin fumes. Fig. (A). Rept. 1889, p. 163.

Smut—Forms black dusty outbreaks on various parts of plant raised from seed; especially injurious to the very young seedlings. This fungus becomes established in the soil, hence infected land should be avoided or used only for transplanted onions. If used, apply with the seed in drills per acre, 100 lbs. sulphur thoroughly mixed with 50 lbs. air-slaked lime. Formalin (1 lb. or 1 pt. to 12 gallons water) thoroughly sprinkled over the seed, before covered, by drip attachment to the seeder, is an even more desirable remedy. Repts. 1889, p. 129; 1895, p. 176.

Stem Rot—Starts rotting of bulbs at stem end, where they become soft and shrunken, sometimes showing beneath the layers a dense olive-brown growth. This fungus in a moist season occurs on various parts of the plant in the field (possibly responsible for "blast" of seed onions), but does not appear as a serious trouble with the bulbs until some time after they have been placed in the barn. Treat as for black spot. Late field spraying with Bordeaux shortly before pulling and again while lying in the field, combined with treatment by formalin fumes (See Fungicides) after storing, has given some indications of benefit. See Fig. (B) under anthracnose. Repts. 1903, p. 334; 1904, p. 321.

PALMS.

Insects.

Scales—Several kinds of white and brown scales infest the species of palms grown in greenhouses. Apply nicotine solution or soap and water as a spray or as a dip.

Fungi.

Anthracnose—Frequently causes leaves to die at tip. Fungus may show as small black imbedded specks oozing pinkish masses of spores. Avoid infected stock or isolate it; pick off and burn worst infected leaves; keep leaves dry and house well ventilated. Rept. 1913, p. 18.

PARSLEY-PARSNIP.

Insects.

Celery Caterpillar—On both hosts. See Celery.

Parsley Stalk Weevil—Larva tunnels in crown of plant. No remedy other than to destroy infested plants. Rept. 1913, p. 252.

Fungi.

Drop—On Parsley. See Lettuce.

Soft Rot—On Parsnip. See Salsify.

PEA.

Insects.

Green Pea Aphid—Attacks the plants early in June and sucks the sap from the leaves and stems, often causing great

injury. Early peas may mature a crop before aphids injure them. Spray or dust vines with nicotine. Brush the vines just before cultivating. Repts. 1899, p. 240; 1913, p. 235; 1924, p. 319.

Pea Weevil—The adult lays eggs in the pods in the field and the larvae develop in the seed, the beetles emerging through round holes. Fumigate with carbon disulphide as soon as harvested. Bull. 195, p. 5.

Fungi.

Leaf Spot and **Powdery Mildew**—Shows in the former as roundish spots on both pods and leaves; in the latter, as a mealy or cobweb-like coating on same. Neither seems to be sufficiently injurious here to warrant the expense of spraying.

Root-Rot—Kills tops of roots and base of vines, causing parts above to turn yellow, wilt and die prematurely. Caused by various soil fungi. Practice rotation, use *well-rotted* manure; give frequent cultivation in wet years to hasten the drying of the top soil; plant most resistant varieties. Bull. 222, p. 450.

PEACH.

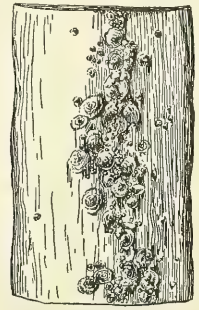
Insects.

Peach Sawfly—Larvae feed upon leaves in June and July. Spray with lead arsenate. Rept. 1907, p. 285.

Peach Borer—Larva tunnels in the base of the trunk. Dig out in late fall and early spring. Paint base of trunk with lead arsenate and lime-sulphur. Remove top soil and sprinkle powdered paradichlorobenzene around the trunk, using about 1 ounce per tree, and cover with soil. Rept. 1909, p. 359.

Oriental Peach Moth—Larvae tunnel new shoots early in season, later broods leave shoots and enter fruit or go direct into fruit; larvae winter in cocoons on bark or on ground. No satisfactory controls yet known. Frequent sprays of nicotine sulphate and soap, cultivation of soil in fall or early spring in localities permitting it, and the use of paradichlorobenzene the same as for peach borer control, have been shown to be of some benefit. Rept. 1924, p. 299.

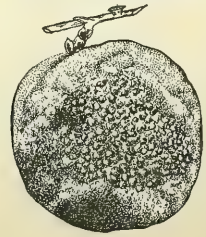
Fruit Bark-Beetle or **Shot-Hole Borer**—Makes minute tunnels under the bark of branches and trunk. Burn infested trees and keep others thrifty. Rept. 1896, p. 240.



Plum Curculio—See Plum.

San José Scale—Minute scale insects, with circular shell, which suck the sap from twigs, fruit and leaves. On fruit a red spot surrounds each insect. Spray dormant trees with lime-sulphur or miscible oils. Bull. 165; Rept. 1901, p. 240.

Black and **Green Aphids**—Suck the sap from the leaves and shoots. Spray with nicotine solution.



Fungi, etc.

Brown Rot—Occurs on the young twigs, leaves and blossoms, but causes most serious injury to the fruit, rotting it about ripening time. The rotten areas become covered with numerous pustules of dusty brownish spores; eventually the diseased fruits form hard mummies. These carry

the fungus over the winter, and if half buried in the soil develop in early spring the mature stage, which causes infection of the blossoms, etc. Certain early varieties, like the Champion, are especially subject to rot. See general directions for treatment. This fungus occurs on plums and cherries and less commonly on pears and apples. Repts. 1909-10, pp. 607, 612; 1911, pp. 374, 391.

Crown Gall—See Plum.

Leaf Curl—Causes young leaves to become irregularly curled and swollen and finally to drop off; rarely on fruit. In April as soon as buds begin to swell, spray the trees thoroughly with commercial lime-sulphur, 1-9. Same treatment takes care of San José scale. Repts. 1909-10, pp. 608, 612; 1911, p. 374; 1914, p. 19.

Powdery Mildew—Forms a grayish felt on young twigs and leaves. Prune off infected twigs; give winter treatment as for leaf curl, and summer treatment as for scab and brown rot.

Scab — Produces roundish, olive-black spots on the fruit, discolored areas on the young twigs, and rarely "shot-holes" in the foliage. Two treatments with self-boiled lime-sulphur, dry mix or Atomic Sulphur upon the fruit after setting and when half grown (about the middle of May and June) will control this trouble. Repts. 1896, p. 269; 1909-10, pp. 608, 614; 1911, pp. 375, 391.

Spray Injury—Is more likely to occur than on apple. Avoid Bordeaux altogether. See (3) under general treatment following. Repts. 1900, p. 219; 1911, p. 372.

Winter Injury—Shows in various ways. In severe winters, especially when the ground is bare, the roots may be killed without injury to parts above the ground. In spring such trees put forth a scanty sickly foliage that soon drops. Often the injury occurs in the form of a "collar girdle" in the bark at the base of the tree. Sometimes it occurs above ground in the wood (shown by its blacker color), with or without injury to the bark. When the bark is not injured, severe pruning in spring will often save the trees. Nursery trees can sometimes be cut back to the snow line, below the injury, and an entirely new healthy trunk started. Avoid late applications of nitrogenous fertilizers and cultivation after middle of July. Mulch base of young trees in late fall with earth. Secure good drainage. Repts. 1903, p. 341; 1908, p. 872.

Yellows—Causes premature ripening and red spotting of fruit, develops yellowish curled leaves, and in time spindling sprout growth in bunches on the trunk. This is claimed to be a contagious disease, but it is apparently physiological in nature. Little peach in this state is scarcely to be distinguished from the yellows, showing chiefly in the small backward fruit. Root out all infected trees; prevent winter injury; be careful in selecting stock for planting. Nurserymen should use especial care in selecting their stock for budding. Repts. 1893, p. 92; 1908, p. 872.

General Treatment for Peach Orchards.

(1) Spraying peaches while dormant is of value only in checking San José scale, mites and leaf curl. One application of commercial lime-sulphur, 1-9, either in late fall, or preferably early spring, will take care of all of these troubles. If the scale and the leaf curl are unusually prevalent both applications will prove of value in controlling them.

(2) For the prevention of scab and rot of peaches, give three sprayings, as follows: 1st, shortly after the blossoms have fallen; 2d, three or four weeks later; and 3d, one month later. Dusting with sulphur may replace spraying where more convenient.

(3) Self-boiled lime-sulphur, dry mix and Atomic Sulphur seem to be the safest and most reliable peach sprays. Fair results have been obtained with some of the commercial lime-sulphurs, and they are much more easily handled. There is, however, some danger of spray injury, especially with certain brands. If commercial lime-sulphur is used, a strength of not greater than 1-150, without poison, is advisable.

(4) As lead arsenate has done little to prevent curculio injury in Connecticut and as it seems to increase the danger of spray injury, we advise leaving it out unless there is considerable danger from the sawfly, when it can be added in the second spraying the same as for apples.

PEAR.

Insects, etc.

Pear or **Cherry Slug**—See Cherry.

Codling-Moth—See Apple.

Brown-Tail Moth—Occurs in the United States only in eastern New England. Brown hairy caterpillars feed on leaves, and make winter nests on twigs, maturing about the middle of June. Cut and burn winter nests. Spray foliage as soon as blossoms fall, and also in August, with lead arsenate. Rept. 1910, p. 683; Bull. 182.

Fall Web-Worm—Makes nests on ends of branches of many kinds of trees in late summer, the brown, hairy caterpillars feeding inside the nests. Clip off and burn nests when small. Spray with lead arsenate. Repts. 1901, p. 270; 1917, p. 319.

San José Scale—See Peach.

Pear Psylla—Small jumping plant lice suck sap from leaves and twigs, causing leaves to fall in midsummer. Spray with lime sulphur 1-9 in spring just before the blossom buds open. Spray again in July with nicotine sulphate and soap, or nicotine sulphate and lime using 20 lbs. of lime to each 50 gallons spray. If infestation is bad spray on warm days in spring or fall with nicotine and soap to destroy adults. Rept. 1903, p. 262.

Sinuate Pear Borer—Grubs tunnel in branches often killing them. Cut out the borers and spray foliage heavily in May with lead arsenate. Rept. 1920, p. 193.

Pear Thrips—A minute insect which feeds upon the unopened fruit buds, destroying them so that fruit does not set. Spray with nicotine solution and soap just as buds open, and again after blossoms fall.

False Tarnished Plant Bug—Punctures developing fruit, causing it to be irregular and knotty. Spray with nicotine solution and soap.

Leaf Blister Mite—Attacks unfolding leaves of apple and pear; forms galls or blisters, which become red and later brown. Causes many leaves to fall in July. Spray dormant trees with lime-sulphur in late fall or in spring. Rept. 1910, p. 700.

Fungi, etc.

Blight—Kills young twigs, the leaves suddenly turning black; also produces sunken dead areas on trunks. This is a bacterial disease chiefly spread by bees during blossoming time, or by sucking insects. Winter-prune all diseased branches, cutting off several inches below diseased area. Cut out cankered areas and swab with disinfectant, paint exposed wood when dry. Several times after blossoming remove all young dead twigs. Use knife sterilized after each cut by

wiping with a cloth saturated with carbolic acid or with corrosive sublimate (1-1000). Rept. 1894, p. 113.

Leaf Blight—See Quince.

Scab—Forms olive-black scabby spots on fruit and leaves, often causing the former to become distorted and cracked. The fungus lives over winter on the twigs. Certain varieties are not much injured, others, like Flemish Beauty, are very susceptible. Spray as for apple scab. Repts. 1894, p. 135; 1904, p. 323; 1911, p. 396.

PEONY.

Insects.

Rose Chafer—Adult beetles feed upon blossoms of white varieties. See Grape.

Fungi.

Stem Rots—Appear in the spring as the new stems push up into the air. Sometimes the tip, the base or the whole stem may die from the rot. Two different fungi cause the same injury. Spray plants and soil as the stems push through the earth; keep soil dry by stirring; destroy infected stems.

PHLOX.

Insects.

Red Spider—Injures leaves, causing them to turn yellow. Clean culture. Spray clear water with force from hose, and in severe infestations, with linseed oil emulsion, kerosene emulsion, or with nicotine solution and soap.

Fungi.

Powdery Mildew—Covers more or less completely leaves and young stems with grayish coating within which are finally imbedded numerous, small, blackish fruiting-bodies. Give several sprayings with commercial lime-sulphur, starting before mildew appears.

PINE.

Insects.

Sawflies—Larvae of several native and imported species feed upon the leaves. Spray with lead arsenate. Rept. 1917, p. 273.

White Pine Weevil—Adult snout beetle lays eggs on leader in May and grubs feed and develop on it, causing it to wilt and die in midsummer. Leaders of ornamental trees may be protected by spraying them with lead arsenate or lime-sulphur. Jarring the adults into a net once a week during month of May serves greatly to reduce the damage. Infested leaders should be cut and destroyed. Repts. 1911, p. 307; 1919, p. 144.

Pine Leaf Scale—Whitish pear-shaped shells on leaves; small trees sometimes killed. Spray with nicotine solution or kerosene emulsion about the second week in June. Rept. 1921, p. 181.

Pine Bark Aphid—White cottony or woolly objects on bark and sometimes on leaves, sucking out the sap. Spray with kerosene emulsion. Repts. 1911, p. 343; 1919, p. 155.

Fungi, etc.

Blight (so-called)—Stunts the leaves and kills their tips, often suddenly, so that the tissues for a greater or less distance are reddish-brown. This is a physiological disease; it is not contagious; due to adverse weather conditions. Chief among these are severe winters, killing the leaves directly or indirectly through injury to roots; warm days, in late winter or early spring when ground is frozen, causing transpiration of water

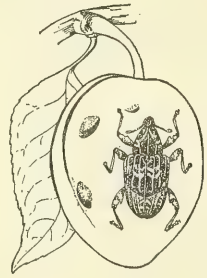
from the leaves that cannot be replaced; very late spring frosts, killing tips of new leaves; sudden changes, in summer from moist or muggy weather to bright sunshine, resulting in excessive transpiration and injury; very dry summers. No effective remedy. Rept. 1907, p. 353.

Dampening Off—Caused here chiefly by Rhizoctonia fungus rotting base of the stem, the seedling falling over. Sometimes it creeps up the stem, invading the base of the leaves which wither. Certain conifers are more subject to attack than others. Avoid unnecessary watering; provide good ventilation; infected soil often can be helped by treatment with formalin before seeding (see Fungicides, formalin D); spraying with Bordeaux is helpful in some cases. Some use sand as a coating over the beds. Repts. 1912, p. 348; 1915, p. 450.

Stem Rusts—Form on the swollen stems temporary, but conspicuous, white, blister-like spore cups filled with a dusty orange-colored spore mass. The white pine blister rust, an imported species, spreads to the gooseberries and currants, and forms other less conspicuous leaf stages on these. A very similar native species on two and three needle pines spreads to the leaves of the sweet fern. In either case infected pines should be destroyed, and also the alternate hosts, if they occur in the neighborhood. Spray seed-beds with Bordeaux if liable to infection. In white pine plantations pull out all currant and gooseberries within 500 feet. Send any suspicious white pines or their alternate hosts to this Station for examination. Rept. 1912, p. 347; Bulls. 214, p. 428, 237, p. 305.

Insects.

Plum Aphids—Suck sap from leaves. Spray with kerosene emulsion, nicotine solution and soap, or with soap and water.



San José Scale—See Peach.

Plum Curculio—Grub infests the growing fruit, causing it to fall. Jar the trees each morning for six weeks after blooming and catch the beetles on sheets and destroy them. Spraying with lead arsenate during the same period is also advised. Rept. 1910, p. 609; Bull. 235, p. 218.

Fruit Bark-Beetle or **Shot-Hole Borer**—See Peach.

Fungi.

Black Knot—See Cherry.

Brown Rot—Is the same as on peach. Thin fruit so it does not touch. Gather and destroy all mummies after harvest. Rather difficult to control by spraying, as spray does not readily adhere to the smooth fruit. First treatment with Atomic Sulphur, dry mix or self-boiled lime-sulphur, should be made on half grown fruit, others at intervals of two weeks, and the last one 7 to 10 days before picking. Use a spreader in the spray.

Crown Gall—Shows hard roundish knots one-half inch or more in diameter, near crown or on roots, less frequently on lower part of trunk. Do not plant infected trees. Remove knots when found and paint over cut surface. This is said to be very troublesome in some states, but here, as yet, little damage has resulted from it.

Insects.

POPLAR.

Poplar Tent-Maker—Larvae feed on leaves and fold them together near ends of branches, forming nests. Spray with lead arsenate. Rept. 1911, p. 310.

Spiny Elm Caterpillar—See Elm.

Tussock Moths—See Apple, Hickory and Horse Chestnut.

Poplar Borer—Larvae make large galleries in wood of trunk. Dig out, or inject carbon disulphide into the burrow and close the opening. Rept. 1907, p. 336.

Poplar and **Willow Curculio**—Larva tunnels in smaller trunk and branches. Destroy badly infested trees. Cut out borers; inject carbon disulphide. Rept. 1907, p. 335.

Oyster-Shell Scale—See Apple.

Fungi.

European Canker—Forms sunken dead areas of varying extent in the bark. Importation from Europe; showing here most commonly on Lombardy and white poplars. If trees are badly injured cut down and burn; otherwise cut out diseased areas going into the healthy bark, scraping and painting over exposed wood. Bull. 222, p. 461.

Rusts—Show on leaves as minute, powdery, yellow-orange pustules in II stage, and as slightly elevated reddish blisters in III stage. Have I stage, for different species, on larch and hemlock. Avoid planting near these hosts in nursery; rake up and burn infected leaves in the fall. Rept. 1915, p. 440.

Insects.

POPPY.

Aphids—Black aphids suck sap from stems and leaves. Spray with nicotine solution and soap.

Insects.

POTATO.

Flea Beetle—Small black jumping beetles eat holes through the leaves. Spray heavily both upper and under leaf surfaces with lead arsenate or calcium arsenate. Bull. 208, p. 103; Rept. 1906, p. 271.

Colorado Beetle—Adults and larvae devour the leaves. Spray with lead arsenate as soon as injury is apparent. May be used in Bordeaux mixture. Bull. 208, p. 106; Rept. 1911, p. 311.

Three Lined Potato Beetle—Larvae feed upon the leaves and carry their black excrement on their backs. Spray with lead arsenate. Bull. 208, p. 109.

Stalk Borer—Larva tunnels inside the stalk. Burn infested vines. See Dahlia. Bull. 208, p. 111.

Leafhopper—Sucks sap from veins, causing leaves to curl and "burn." Known as "hopper burn." Spray or dust with nicotine to kill leafhoppers.

Potato Aphid—Green and pink aphids appearing in large numbers suck the sap from shoots and stems, causing much damage in 1917. Spray or dust with nicotine. Bull. 208, p. 115.

Fungi, etc.

Black Leg—Ends as a black rot of stem below ground; makes plants usually stunted with yellowish curled foliage; occasionally rots tubers. Usually only scattered plants appear in the field, not spreading to the healthy. Soaking seed in formalin as for scab is helpful. Plant only certified seed. Rept. 1914, p. 21.

Blight or **Downy Mildew**—Causes a sudden blackening of the leaves, and death of vines, from July to September in moist seasons; usually shows a slight whitish growth of fungus on the under side of the leaves; rots tubers. Spray with Bordeaux before the trouble appears, about July 1, and keep vines *well covered* to the end of the season. Three to five sprayings by hand or five to seven by power sprayer are necessary. Use lead arsenate in the early sprayings for insects. After last cultivation thoroughly ridge up the rows to help keep the spores from washing down to the tubers. Early varieties usually escape blight by maturing before its appearance. Repts. 1904, p. 363; 1905, p. 304; 1909-10, p. 739; 1915, p. 470; 1916, p. 355; Bull. 214, p. 411.

Mosaic—Shows as a more or less conspicuous yellow-green mottling of the leaves. A physiological disease not well understood. Common here, but apparently not so injurious as in some other places. Do not save tubers for planting from fields showing this trouble. Keep down aphids. Use only certified seed. Bull. *222*, p. 464.

Scab—Produces the common scabby appearance on surface of tubers. Soak uncut seed-tubers one hour in formalin (formula C). Formalin fumes (see Less-Used Fungicides) are often used when large quantities are treated. Care in filling space sufficiently, however, is necessary to avoid injury by "pitting" from absorption of fumes. Corrosive sublimate is recommended by some investigators, especially where the black scurf (Rhizoctonia) also occurs on the tubers, as this treatment seems more effective against the latter. Pre-sprinkling with water 48 hours before treatment and keeping moist meantime is said to increase their efficiency. Hot corrosive sublimate or formalin for short periods has also been recommended for potato tuber diseases. Avoid planting on infected land. The use of lime, wood ashes, and various barnyard manures will increase the amount of scab. The same trouble occurs on beets and turnips. Fig. (B). Repts. 1890, p. 81; 1891, p. 153; 1894, p. 118; 1895, p. 166; 1896, p. 246; 1909-10, p. 744.

Tip or **Hopper Burn**—Causes leaves to die at tip and margins and roll up; often mistaken for true blight. This is a physiological trouble due to drought or sudden change from moist to very hot bright weather or to leafhoppers. Cultivate thoroughly and often to conserve moisture. Spray with Bordeaux as for blight, as this often helps to increase yield by lengthening life of leaves. Rept. 1909-10, p. 742.

PRIVET.

Insects.

Aphids—Suck sap from the leaves causing them to curl. Spray with nicotine sulphate or apply nicotine dust.

Fungi, etc.

Anthracnose—Forms small cankers on stems, causing parts above to wilt and die. Usually found in nurseries on recently transplanted European privet. Prune off and burn infected branches; spray with Bordeaux. Rept. 1914, p. 22.

Winter Injury—Shows in spring by stems usually being killed down to base or snow line. Cut off dead stems below injury and a vigorous new growth will result if roots are not injured. Rept. 1904, p. 326.

QUINCE.

Insects.

Aphid—See Apple.

Oriental Peach Moth—See Peach.

Quince Curculio—Grubs infest growing fruit and adults feed upon it, causing it to be knotty. Jar the trees same as for plum curculio. Spray with lead arsenate about July 1, and repeat in 10 days.

Round-Headed Borer—See Apple.

Fungi, etc.

Black Rot—Affects the fruit, often beginning at the blossom end; also kills twigs and branches. In the fall or spring cut off and burn all dead branches. Give three sprayings, as for leaf blight, with Bordeaux mixture.

Blight—See Pear.

Leaf Blight—Appears as rounded, often confluent, reddish-brown spots with central black dots on leaves and as black sunken specks on fruit, the former often shedding prematurely and the latter cracking irregularly. Spray with Bordeaux just before blossoms open, again soon after they fall, and follow with one or two additional treatments at intervals of about two weeks, according to the weather. This fungus also occurs on pear. Repts. 1890, p. 99; 1891, p. 150.

Rust—Produces small clustered cups, with fringed borders, filled with orange spores, on fruit, young twigs and less frequently on leaves. Cut off and burn infected twigs and fruit. Look for infected cedars in neighborhood.

RADISH.

Insects.

Maggot—See Cabbage.

Aphid—See Turnip.

Fungi.

Club Root—See Cabbage.

RASPBERRY.

Insects.

Raspberry Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore. Rept. 1918, p. 329.

Cane Borer—Larva tunnels inside the canes. Cut and burn infested canes.

Raspberry Fruit-Worm—Brown beetles feed upon buds, leaves and blossoms, and white larvae adhere to berries at picking time. Spray with lead arsenate when beetles first appear. Bull. 251.

Fungi, etc.

Anthracnose—Shows as more or less confluent whitish spots, with purplish borders, on the stems. In spring, before buds swell, cut out and burn all badly infected canes and then spray with Resin-Bordeaux or Bordeaux with a casein spreader. If disease is very bad, spray again when young shoots are about six inches high, and repeat in 10 to 14 days. Aim chiefly to cover the young shoots with the spray. After fruit is gathered, again remove any badly infected canes. Cultivate ground thoroughly to promote vigorous growth of canes. Rept. 1899, p. 274.

Crown Gall—See Blackberry.

Rust—See Blackberry.

Wilt—Forms cankered areas on the canes, causing the parts above to wilt. In the old canes and near the pruned ends, the fungus often develops a brownish coating of spores around each small imbedded fruiting receptacle. Spraying has not proved very satisfactory. Old and diseased canes should be removed and burned after the fruiting season and again early in spring. Rept. 1906, p. 321.

Yellows—Is a more general term for Mosaic (mottled leaves), leaf curl and blue stem, three diseases causing serious

trouble here. Plants gradually become worthless. Spraying, except for aphids, does not help these troubles. Dig out infected plants. Propagate only from perfectly healthy and most resistant varieties, or buy from inspected stock.

RHODODENDRON.

Insects.

Rhododendron Lace Bug—This bug sucks the sap from the under side of the leaves, which are usually colored brown by its excrement. Spray with nicotine solution or kerosene emulsion. Rept. 1921, p. 201.

Rhododendron Borer—Tunnels under bark of stems around crotches. Cut out borers and cover wounds with melted paraffin. Rept. 1922, p. 347.

Fungi, etc.

Leaf Scorch—Shows as dead marginal areas of varying width usually appearing suddenly. Plant in shade; keep ground mulched; water if necessary in dry weather by soaking ground beneath mulch. Rept. 1914, p. 23.

ROSE.

Insects.

Rose Slug—Eats away the green portion of the leaves. Spray with hellebore, lead arsenate or nicotine solution.

Rose Midge—Larvae distort young leaves and flower buds in greenhouses. Apply tobacco dust to the soil and fumigate nightly with tobacco stems or nicotine paper.

Rose Chafer—See Grape.

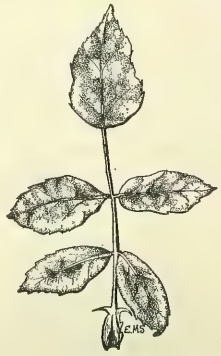
Leafhopper—Sucks the sap from the under side of the leaves. Spray with nicotine solution and soap.

Rose Scale—Whitish circular shells on the stems contain insects which suck the sap. Cut and burn worst infested canes. Spray with nicotine solution and soap. Bull. 151, p. 11; Rept. 1905, p. 241.

Aphid or **Green Fly**—Sucks sap from the leaves and stems. Spray with nicotine solution.

Fungi, etc.

Crown Gall—Occurs very frequently on rose roots, especially those of Manetti stock. Use cleaned tools in grafting and avoid infected plants. See Plum. Rept. 1911-12, p. 355.



Leaf Blotch—Forms large purple-black blotches on leaflets which often turn yellow and fall off. For greenhouse treatment paint hot water pipes with mixture of sulphur and oil. Potassium sulphide or commercial lime and sulphur can be sprayed on the foliage. Spraying out of doors can be done with Bordeaux, if there is no objection to the sediment on leaves. Rept. 1903, p. 355.

Mildew—Develops a white powdery or cobweb-like growth on the young leaves, which become more or less distorted and fall off; occasionally blasts blossoms of certain varieties. Tea roses especially susceptible. Treat same as for leaf blotch; or dust flowers of sulphur over the leaves; be careful in airing greenhouses. Rept. 1903, p. 356. Bull. 222, p. 474.

RUTABAGA, See **TURNIP.**

Insects.

RYE.

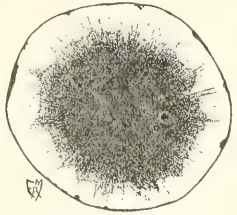
Army Worm—See Grass.

Wheat Midge—See Wheat.

Fungi.

Ergot—Forms conspicuous, elongated, purplish sclerotia, usually one in the spike, most common in volunteer rye, but occasionally in cultivated fields. Keep these sclerotia out of cattle feed, as they may cause abortion and other troubles.

Powdery Mildew—Shows as a thick grayish felt on the leaves with fruiting bodies as blackish embedded specks. Causes premature death of leaves; often associated with rust. No practical remedy. Rept. 1909-10, p. 735.



Fungi, etc.

SALSIFY.

Soft Rot—Caused by bacteria in the interior tissues of the roots, running down from the crown, and turning them a darker color. Usually occurs after storage. Avoid contaminated manure and too much rotting humus in the fields; store under dry cool conditions, allowing sufficient ventilation. Rept. 1914, p. 25.

Insects, etc.

SNAPDRAGON.

Leaf Mites—Cause leaves to curl and plants do not blossom. Spray with nicotine solution and soap, same as for Cyclamen. Rept. 1914, p. 176.

Root-Knot Eelworm—Causes irregular swellings on the roots where the eelworms are present, with resulting premature decay and sickly appearance of parts above ground. Worst in greenhouses and hotbeds, as this far north the nematodes are killed in unprotected ground over winter. Attacks roots of a great variety of cultivated plants. Purchase only healthy plants; change infected soil if possible, dry out thoroughly in summer, leave out doors over winter or sterilize with steam; avoid contamination of soil with infected refuse. Rept. 1915, p. 452.

Fungi.

Anthracnose—Shows as whitish spots with distinct purplish border on leaves and stems; spots often run together. Select seed and cuttings only from healthy stock; pick off and burn infected leaves. Spray with Bordeaux.

Rust—Forms reddish-brown, roundish pustules chiefly on under side of leaves, causing tissues above to become yellow spotted. Appears in greenhouses and causes more or less injury according to prevalence. Treat as for anthracnose. Rept. 1915, p. 443.

Insects.

SNOWBALL.

Aphids—Suck sap from the leaves, causing them to curl. Use nicotine solution and soap as a spray or dip.

SOY BEAN.

Fungi, etc.

Bacterial Leaf Spot—Appears as small, dark, reddish-brown angular spots frequently merging into larger areas. Certain varieties are more susceptible than others, Ito San being one of the worst. Grow least susceptible varieties and if possible purchase seed from uninfected fields.

Crinkling Chlorosis—Shows as crinkling or yellowish-green mottling of leaves, or both together. Plants less vigorous than normal ones. Hollybrook variety apt to show trouble most. Treatment same as in preceding.

SPINACH.

Insects.

Spinach or **Beet Leaf-Miner**—See Beet.

Fungi.

Downy Mildew Blight—Forms conspicuous yellow spots on the leaves with a purplish-gray growth on the under surface. Unusually conspicuous recently. Little resistance shown by any variety. Disease worse in wet springs and in fields where spinach has been grown for some years. Practice rotation in isolated fields if feasible. Keep down the weed called Lambs Quarters as it is attacked by same fungus and is chiefly responsible for harboring the mature stage over winter.

SPIRAEA.

Insects.

Aphids—Suck sap from the new shoots. Use nicotine solution and soap as a spray or dip.

SPRUCE.

Insects.

Spruce Gall Aphid—Forms galls at the base of the new growth on Norway and other spruces. Spray in the late fall or early spring with nicotine solution and soap or with kerosene emulsion. Repts. 1906, p. 302; 1922, p. 357.

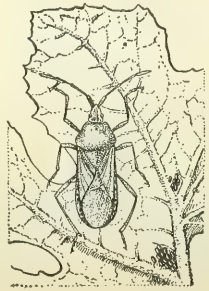
Spruce Bud Moth—Larva feeds on leaves of terminal shoots of the branches, causing much damage. Spray with lead arsenate. Rept. 1922, p. 357.

SQUASH-PUMPKIN.

Insects.

Squash Lady-Beetle—Both adults and larvae devour the leaves. Spray with lead arsenate. Bull. 181, p. 11; 216, p. 42; Rept. 1908, p. 810.

Striped Cucumber Beetle—See Cucumber.



Squash Bug or **"Stink Bug"**—A brown bug three-fourths of an inch in length sucks the sap from the under side of the leaves, which wilt and die. Spray with kerosene emulsion to kill the young. Bull. 216, p. 44; Rept. 1908, p. 811.

Squash-Vine Borer—Larva tunnels in the base of the stem, causing decay. Spray once a week during July around base of stems with nicotine sulphate (1-250). Cut slits lengthwise in the stem and kill borers.

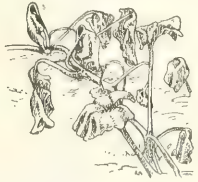
Cover the joints of the vine with earth so that new shoots may be formed to support the plant. Grow a few early plants for traps, and destroy them. The main crop should be planted rather late. Bull. 216, p. 39; Rept. 1908, p. 806.

Fungi, etc.

Anthracnose—See Watermelon.

Storage Rots—Caused by various fungi that are best held in check by storage under conditions with minimum of heat and moisture.

Wilts—Cause leaves of the plants to wilt and then dry up, sometimes all of the vine thus suddenly dying. If a cross section of the stem shows a slight milky and sticky exudation, it is caused by bacteria that clog up the water ducts. Fungi in the ducts or insects at the roots may cause similar injury. Heavy manuring often develops these troubles. Spraying is of little value except as it may keep off insects which inoculate the plants with the bacteria. Use enough seed to allow for loss by wilt and pull up and destroy all the wilted vines as they appear. Rept. 1903, p. 359.



STRAWBERRY.

Insects.

Strawberry Sawflies—Larvae devour leaves. Spray with lead arsenate or hellebore.

Strawberry Weevil—Small snout beetles; females cut off blossom buds of staminate varieties when ovipositing. Plant pistillate varieties in part. Dust heavily with lead arsenate and sulphur (1-5).

Strawberry Crown Borer—Grub tunnels and feeds in crown of plant. Practice crop rotation. Burn over infested field in fall.

Strawberry Flea Beetle—Adults eat holes through the leaves. Spray with lead arsenate.

Strawberry Leaf Roller—Larva rolls leaf and feeds inside. Spray with lead arsenate. Burn fields and plow abandoned fields as soon as crop is harvested.

Strawberry Root Aphid—Sucks sap from leaves and roots, killing plants. Set clean plants on land not infested. Spray with nicotine solution and soap.

Strawberry White Fly—Sucks sap from leaves. Under spray with nicotine solution and soap.

White Grubs—See Grass.

Fungi.

Leaf Spot and **Blotch**—Appear as conspicuous discolored spots, the former usually with whitish centers and purplish borders, and the latter with dark centers. Glen Mary sometimes severely injured by latter. Renew the beds frequently. In the late fall or early spring cut off leaves with mower, add a little straw where necessary, and burn over beds. Spray with Bordeaux two or three times before blossoming, beginning last of April and repeating weekly, and once after blossoming is over. Repts. 1903, p. 360; 1914, p. 5.

Powdery Mildew—Covers leaves (more frequently on under, but more conspicuously, when present, on upper surface) with cobweb-like growth, often causing them to become stiff and curled inward. This can be controlled with Bordeaux if sprayed before abundant. Rept. 1905, p. 276.

SWEET PEA.

Insects.

Aphids—See Pea.

White Fly—See Tomato.

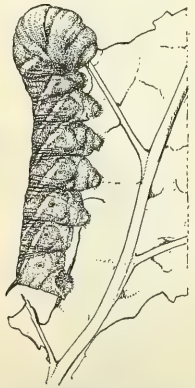
Fungi.

Dampening Off—Rots off stem just below ground, causing vines to turn yellow and finally die. Plant in well drained soil; place well-rotted manure deep in ground below the seed; avoid excessive watering; spray base of vines and ground with Bordeaux; change beds if appearing yearly. Rept. 1907, p. 359.

SYCAMORE.

Fungi.

Anthracnose—Kills young leaves in the spring; causes dead areas of irregular shape in tissues of older ones often following veins. If thought advisable to spray, use Bordeaux on the leaves as soon as showing and repeat when half and full grown.



TOBACCO.

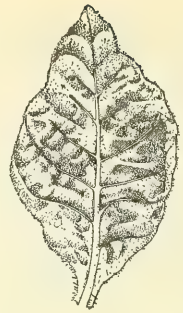
Insects.

Tobacco or **Tomato Horn-Worms**—Large green caterpillars with horn on the tail devour the leaves. Practice hand picking or spray or dust the plants with lead arsenate. Rept. 1906, p. 269.

Flea Beetle—Adults eat holes through the leaves. Spray upper and under surface heavily with lead arsenate. Bull. 208, p. 103; Rept. 1906, p. 271.

Cut-Worms—See Tomato.

Wire-Worms—Occasionally destroy newly set plants under cloth by tunneling in the stems below the surface of the ground. Trap plants will attract the wire worms, which may be killed with cyanide before setting the main crop.



Fungi, etc.

Calico—Causes the leaves to become irregularly mottled with a lighter green color and makes a very inferior tobacco. Frequently infected leaves finally show numerous, irregular, often merging, brown spots known as "rust." While calico is a so-called physiological disease, it can be communicated to a healthy plant through contact with a very small amount of juice from a diseased plant. Care, therefore, is necessary after handling diseased plants in touching healthy ones. Never use tobacco water or tobacco stems on the seed beds. If calico shows in a seed bed, pull up all suspicious plants and those surrounding them. If troubled year after year, sterilize the seed beds or change them, and never make them on land used for tobacco the year before. When transplanting, wash the hands occasionally with soap and water. Repts. 1898, p. 242; 1899, p. 252; 1914, p. 357; Bull. 166, p. 10.

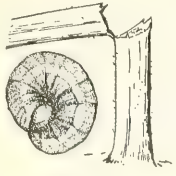
Dampening Off—Due to various fungi which rot off the seedlings or their roots. Keep air of beds as dry as consistent with good growth by care in watering and ventilating. If trouble starts in spots, take out all infected plants and refuse there.

Black Root Rot—Shows in seed beds by dwarfed "rosette" plants whose roots have been largely rotted off. Frequently it does damage in fields, especially where Havana has long been cultivated, but Round Tip is little injured; a short rotation is advisable in bad cases. Sterilize seed beds with steam or treat with formalin (formula D). Repts. 1906, p. 342; 1907, p. 363.

Wild Fire—Shows first in lower leaves as small, roundish, yellow spots. In time these grow larger, turn darker, and irregular dead areas appear more or less prominently. This disease is caused by bacteria and is favored by wet weather. It is carried on the seed and later may be readily transferred from infected places in the field by certain insects and the wind. Care should be used to select seed only from disease-free fields and sow this seed in sterilized seed bed. Where doubtful seed is used this should be soaked for 10 minutes in corrosive sublimate, rate of 1 to 1,000 parts water, stirring the seed during the treatment. Drain off the liquid, wash seed in pure water several times and dry before storing. Old cloth used previously on infected beds should be boiled in water before used again. Spray the beds, with Bordeaux mixture, shortly after the young plants have rooted, repeating every week until the setting season is over.

TOMATO.

Insects.



Cut-Worms—Eat off plant near ground or climb the plant and devour the leaves. Place around field poisoned bait or bran mash containing arsenic. Trap cut-worms with small piece of board. Rept. 1906, p. 264; Bulls. 190, p. 18; 208, p. 112; 216, p. 43.

Tomato or **Tobacco Horn-Worm**—See Tobacco.

Flea Beetle—See Potato or Tobacco.

Potato Aphid—See Potato.

Stalk Borer—See Dahlia.

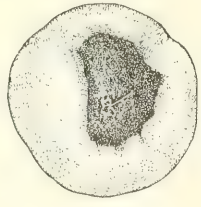
White Fly—Sucks the sap from under side of leaves. Spray under side of leaves with soap and water. Fumigate greenhouses with hydrocyanic acid gas (½ oz. to 1000 cubic ft.). Bulls. 140; 216, p. 50; Rept. 1902, p. 148.

Fungi, etc.

Bacterial Canker—Shows as small brownish streaks of dead and collapsed tissue running down the sides of the stems; at first may be concealed by the epidermis. The infected stems with their leaves soon wither and die. Badly infected fields are sometimes worthless. First seen here in a limited way in 1924, but was more frequent and serious the next year. Use seed from healthy plants only, or if uncertain treat seed. If necessary make new seed beds. Practice rotation, and especially avoid fields where disease has occurred.

Mosaic—Rept. 1908, p. 857. See Calico of Tobacco.

Leaf Spot—Produces on leaves and stems numerous, small, dark spots, often with white centers. Begin spraying with Bordeaux about the middle of July, making 3 or 4 applications at intervals of 10 to 14 days. This usually develops too late in the season here to cause serious damage.



Point Rot—Causes the green fruit to rot at bloom end, showing a large, firm, dark-brown area. Claimed to be a physiological trouble. Frequently bad in very dry seasons. In greenhouses sub-irrigation is said to prevent it. Spraying is of little value. Considerable difference exists in varieties as to susceptibility.

Scab—Occurs most commonly in greenhouses, covering under surface of leaves more or less abundantly with an olive-brown growth which finally kills the tissue above. Spray with Bordeaux, picking ripe fruit before each of the later treatments.

Wilt—Occurs here chiefly in greenhouses; plants turn yellow and slowly wither up; fungus may finally show on dead

stem and fruit as pinkish growth. Caused by fungus clogging ducts and cutting off water supply to leaves; in young stage presence shown by blackened bundles where stems are cut across. Change soil if appearing yearly; do not sow seeds from infected plants, as they can carry the disease. Spraying of no value. Rept. 1903, p. 366.

TULIP TREE.

Insects.

Tulip Tree Scale—Large brown hemispherical soft scales on bark, sucking the sap, especially on lower branches. Spray with lime-sulphur when trees are dormant. Oils may cause injury. Rept. 1921, p. 176.

TURNIP-RUTABAGA.

Insects.

Cut-Worms—See Tomato.

Cabbage Maggot—See Cabbage.

Turnip Aphid—Green aphids on under side of leaves sucking the sap. Dust with nicotine. Repts. 1916, p. 98; 1922, p. 346.

Fungi, etc.

Club Root—See Cabbage.

Soft Rot—Causes an interior soft decay of roots, etc., of a variety of vegetables, such as turnips, salsify, parsnips, carrots, celery. Very wet seasons and imperfect storage conditions are usually the starting point of these troubles. Store under best possible conditions for keeping down heat and moisture. Keep contaminated refuse out of manure pile. Rept. 1914, p. 25.

Phoma Rot—Appears usually after storage, causing conspicuous, dry, sunken, subcircular, black spots scattered over roots. Fruiting pustules show as black dots. Store roots in cool dry place and not too deeply in the piles. Practice yearly rotation and keep refuse from manure pile. If necessary, use only artificial fertilizers. Rept. 1912, p. 355.

VIOLET.

Insects, etc.

Violet Gall Midge—Larvae in curled edges of new leaves. Fumigate every other night with hydrocyanic acid gas (½ oz. to 1000 cu. ft.) until galls disappear. Exposure not less than two hours. Rept. 1921, p. 152.

Violet Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Eelworms—Form galls on the roots. Plant in new soil or sterilize the old soil by steam. Add plenty of air-slaked lime to the soil. See Snapdragon.

Fungi.

Spot Disease—Shows as whitish round spots on the leaves. Spray field plants early in fall with Bordeaux. Select only best stock for greenhouse; remove *all* affected leaves before transplanting. When plants have become established, spray again with Bordeaux. Be careful about watering plants, and, by proper ventilation and heat during September to November, keep atmosphere of house from ever becoming too moist.

WALNUT.

Insects.

Walnut Caterpillar—Clusters of black caterpillars covered with whitish hairs strip the branches and finally the trees in August. Spray with lead arsenate. Clip off twigs when caterpillars are small, and kill by crushing. Repts. 1914, p. 191; 1917, p. 326.

Walnut Weevil or **Curculio**—Adults feed at base of leaf stems. Larvae tunnel in new shoots and infest the fruit of Persian and Japanese walnuts. Spray with lead arsenate. Rept. 1912, p. 240.

Walnut Bud Moth—Larvae feed upon tender leaves and shoots, webbing them together. Spray with lead arsenate. Rept. 1912, p. 253.

WHEAT.

Insects.

Army Worm—See Grass.

Hessian Fly—Maggots burrow in sheath of a leaf at base of stem, causing the stalks to turn yellow and die. Plant late.

Wheat Midge—The fly lays eggs on the chaff and the maggots feed upon the developing kernels, so that the heads ripen early and produce no grain. Burn stubble before plowing. Plow infested fields deeply in the fall. Rept. 1917, p. 366.

Green Bug or **Aphid**—Green aphids suck the sap from leaves. Destroy in early fall all volunteer wheat and oats. Practice crop rotation.

Fungi.

Black Stem Rust—See Oats.

Leaf Rusts—Form small, dusty, orange-colored outbreaks on leaves, etc., and later darker and firmer mature stage. Several closely related species on barley, rye, and wheat but quite distinct from black stem rust. Some varieties are more resistant than others to these various grain rusts. No effective treatment.

Loose Smut—Destroys entire head, turning it into a dusty olive-black mass that is dissipated in time. Soak seed for 4 hours in cold water then treat, after standing in sacks 4 hours more, for 5 minutes in hot water at temperature of 133° F., or use formalin (B) dry sprinkle. Dry thoroughly if stored.

Stinking Smut—Fills the apparently scarcely changed seeds with a dusty mass of spores. Spores often found more or less abundantly in middlings and other feeds containing wheat, and their presence in amount indicates poor quality, and may have some connection with complaints of injury to stock fed on these. Use formalin treatment. Rept. 1909-10, p. 736.

WILLOW.

Insects.

Fall Web Worm—See Pear.

Spiny Elm Caterpillar—See Elm.

Poplar Tent-Maker—See Poplar.

Poplar and **Willow Curculio**—See Poplar.

Sawflies—Larvae devour leaves. Spray with lead arsenate.

Imported Willow Leaf Beetle—Larvae and adults feed upon the surface of the leaves of smooth-leafed species, soon skeletonizing them. Spray with lead arsenate. Rept. 1921, p. 195.

Aphids—Large reddish aphids congregate on twigs in fall, and suck the sap. Spray with kerosene emulsion or nicotine solution and soap.

Oyster-Shell Scale—See Apple.

Fungi.

Rusts—Occur on the leaves; similar in appearance and closely related to those on poplar. The alternate host for one species is the larch and apparently there is another the alternate host of which is not yet determined. Rept. 1915, p. 450.

MANUFACTURERS AND DEALERS IN SPRAY APPARATUS AND SUPPLIES.

Prospective purchasers should write to these firms for catalogues and prices.

MANUFACTURERS OF SPRAYING MACHINES.

Barnes Mfg. Co., The, Mansfield, Ohio. (Hand sprayers.)
Bateman Co., Fred. H., Grenloch, N. J. (Iron Age sprayers, traction and power.)
Bean Spray Pump Co., Lansing, Mich. (Hand and power sprayers and dusters.)
Brown Co., E. C., Rochester, N. Y. (Compressed air, hand and power outfits.)
Burch Plow Works Co., The, Crestline, Ohio. (Sprayers.)
Church, Stephen B., Seymour, Conn. (Power and hand sprayers.)
Church-Tyler Co., 210 Congress St., Boston, Mass. (Power and hand sprayers.)
Dayton Manufacturing Co., The, 2240 East Third St., Dayton, Ohio. (Hand sprayers.)
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Dobbins Bros. Mfg. Co., North St. Paul, Minn. (Hand dusters.)
Ellis Co., Wm. O., Concord Junction, Mass. (Spraying materials, Peerless Hand dusters.)
Field Force Pump Co., Elmira, N. Y. (Hand, traction and power spraying machines.)
Fitzhenry-Guptill Co., 135 First St., Cambridge, Mass. (Power sprayers.)
Friend Mfg. Co., Gasport, N. Y. (Spraying outfits, power and hand spray pumps and all sprayer accessories.)
Goulds Mfg. Co., 177 High St., Boston, Mass.; 16 Murray St., New York. (Hand and power sprayers.)
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Ellis Company, Wm. O., Concord Junction, Mass. (Dusting and spraying materials. Peerless hand dusters.)
Frost Insecticide Co., Arlington, Mass. (Spray chemicals and apparatus.)
General Chemical Co., 40 Rector St., New York City. (Orchard Brand Spray and Dust Materials.)
Glidden Co., The, Cleveland, Ohio. (Insecticides and fungicides.)
Golden State Sales Corporation, 175 Franklin St., New York City. ("Kayso," Calcium caseinate spreader.)
Grasselli Chemical Co., The, 347 Madison Avenue, New York City. (Insecticides and fungicides.)

Heil Chemical Co., Henry, 210-214 So. Fourth St., St. Louis, Mo. (Spray chemicals.)
Hemingway & Co., Inc. (The Sherwin-Williams Co.), 292 Madison Ave., New York City. (Arsenical poisons.)
Interstate Chemical Co., 12-20 Bay View Ave., Jersey City, N. J. (Insecticides and fungicides.)
Lavanburg Company, Fred L., 160 William St., New York City. (Arsenical poisons.)
Mechling Bros., Chemical Co., Camden, N. J. (Insecticides and fungicides.)
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Sherwin-Williams Co., The, 601 Canal Road, Cleveland, Ohio. (Insecticides and fungicides.)
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Gilman, Alexander & Co., Inc., Putnam. (Spray apparatus, insecticides and fungicides.)
Grasselli Chemical Co., 46 River St., New Haven. (Insecticides and fungicides.)
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Judson Company, The Dwight R., 237 State St., Hartford. (Insecticides and fungicides.)

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